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EMR^3

Installation Guide

VEEDER-ROOT

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Introduction

General

This manual covers truck and terminal installation of the Veeder-Root Electronic Meter Register (EMR^3) System. The EMR^3 System consists of three major components:

- **Display Head (DH)** - The Display Head component, approximately 8.25” x 10” x 4.25” (210 x 254 x 108 mm), replaces the mechanical register on a truck or a terminal fuel flow meter. Using the Display Head front panel display and the keys on its face, the operator can choose to dispense either a preset or a variable quantity of product. An optional Temperature Probe is available for temperature compensated product deliveries.

  The Display Head must be configured and calibrated before it is placed in service. Once the initial Configuration and Calibration procedures are complete, the Display Head is sealed for weights and measures certification.

- **Interconnection Box (IB)** - The IB component is a small metal box, approximately 8” x 10” x 3” (203 x 254 x 76 mm), that contains the EMR^3 System control circuitry. The IB is mounted in the truck cab or the terminal office. The IB provides an intrinsically-safe barrier for connections to one or two Display Heads located at dispensing points in the hazardous area. The IB can be ordered to accept 12 or 24 Vdc input power as required.

  The IB can also control up to two optional single- or dual-stage knockoff valves per Display Head.

- **Printer** (optional) - The printer, approximately 7” x 7.5” x 4” (178 x 191 x 102 mm), is mounted in the truck cab or terminal office and prints a multi-part ticket; one part of the ticket is given to the customer upon delivery of the product, and the other part is used to invoice the customer.

System Specifications

- **System power:** 12 or 24 Vdc, ±20%, 3 A nominal, fused @ 5 A
- **Pulser Capacity:** 0 - 1000 Hz
- **Product Dispensing Precision:** to 0.2% of the proving volume at 60°F (15.6°C)
- **Product Dispensing Repeatability:** to 40% of the accepted tolerance (0.2% x 40% = 0.08%)
- **Temperature compensation resolution:** to within 0.2% of the proving volume at 60°F (15.6°C)
- **Temperature compensation range:** -45 to +158°F (-50 to +70°C)
- **Communication between Display Head and IB:** RS-485; 2-wire half duplex; custom protocol; 19,200 baud; 8 bit binary; no parity; 1 stop bit
- **Communication between Printer and IB:** RS-232; 9600 baud; 8 bit; no parity; 1 stop bit
- **Display Head and IB Operating temperature range:** -13 to +158°F (-25 to +70°C)
- **Display Head and IB Storage temperature range:** -40 to +185°F (-40 to +85°C)
- **Solenoid Relays:** Two relay contacts per Display Head rated at 5 A, 120 Vac, 24 Vdc.
- **Printer power:** +24 Vdc, 2 A (supplied by the IB)
- **Printer Operating temperature range:** +32 to +122°F (0 to +50°C)
- **Printer Storage temperature range:** +32 to +122°F (0 to +50°C)
- **Weights and Measures:** Designed to meet NIST, OIML, and Canadian W&M specifications

Available Parts

All available EMR3 system parts, including options, are listed below.

- Display Head (V-R #845693-XXX)
- Display Head Cord Grip and Lead Seal Kit (V-R #330020-423)
- Keypad Group (V-R #846000-014)
- Bracket with Encoder Installation Kit (V-R #846000-015)
- Printer Tray Stop Switch (V-R #846000-016)
- C&C Switch Group, Normally Closed (V-R #846000-017)
- C&C Corner Switch Group, Normally Open (V-R #846000-018)
- Printer Kit (V-R #846000-020)
- Temp Probe Kit (V-R #846000-002)
- 3-Way Solenoid Valve Kit (V-R #846000-003)
- Interconnection Box (V-R #845893-XXX)
- Interconnection Box Installation Kit (V-R #846000-012)
- Display Head Hookup Cable: 4-conductor cable from 6 to 500 feet (1.83 to 152.4 m) lengths (V-R #846000-1XX)
- 3-Way Solenoid Valve Kit (V-R #846000-003)
- Emergency Stop Switch (ESS) Kit (V-R #846000-021)
- Suppressor Diode Kit (V-R #846000-022)
- Remote Display Head (V-R#845693-X2X)
- Remote Display Bracket Install Kit (V-R #846000-024)
- RS-232 Cable Kit (V-R# 330020-431 [1 foot{30.5 cm}, -432 [10 feet {3.04 m}])

If the EMR3 Display Head will be installed in other than replacing a V-R Mechanical Meter Register, you must also have the Veeder-Root approved installation kit for that meter:

- Liquid Controls Installation Kit (V-R #846000-006)
- Tokheim, Daniels & Donovan Installation Kit (V-R #846000-004)
- Smith Meter Installation Kit (V-R #846000-005)
- Neptune w/Temp. Compensation Installation Kit (V-R #846000-008)
- Neptune w/o Temp. Compensation Installation Kit (V-R #846000-009)
- Display Head General Purpose Linkage Kit (V-R #846000-007)

Safety Symbols

The following safety symbols may be used throughout this manual to alert you to important safety hazards and precautions

	EXPLOSIVE Fuels and their vapors are extremely explosive if ignited.		**FLAMMABLE** Fuels and their vapors are extremely flammable.
	NO OPEN FLAMES Open flames from matches, lighters, welding torches, etc. can ignite fuels and their vapors. Do not smoke while installing this equipment.		**TURN POWER OFF** Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.
	WARNING Heed the adjacent instructions to avoid equipment damage or personal injury.		**GLOVES** Wear gloves to protect hands from irritation or injury.
	WEAR EYE PROTECTION Fuel spray from residual pressure in the lines can cause serious eye injuries. Epoxy sealant can cause eye injury. Always wear eye protection when working with pressurized lines and epoxy mixtures.		**READ ALL RELATED MANUALS** Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does.

Safety Warnings

⚠ WARNING

This system operates near highly combustible fuel storage tanks.

Fire or explosion resulting in serious injury or death could result if the equipment is improperly installed or modified or is used in any way other than its intended use. Serious contamination of the environment may also occur.

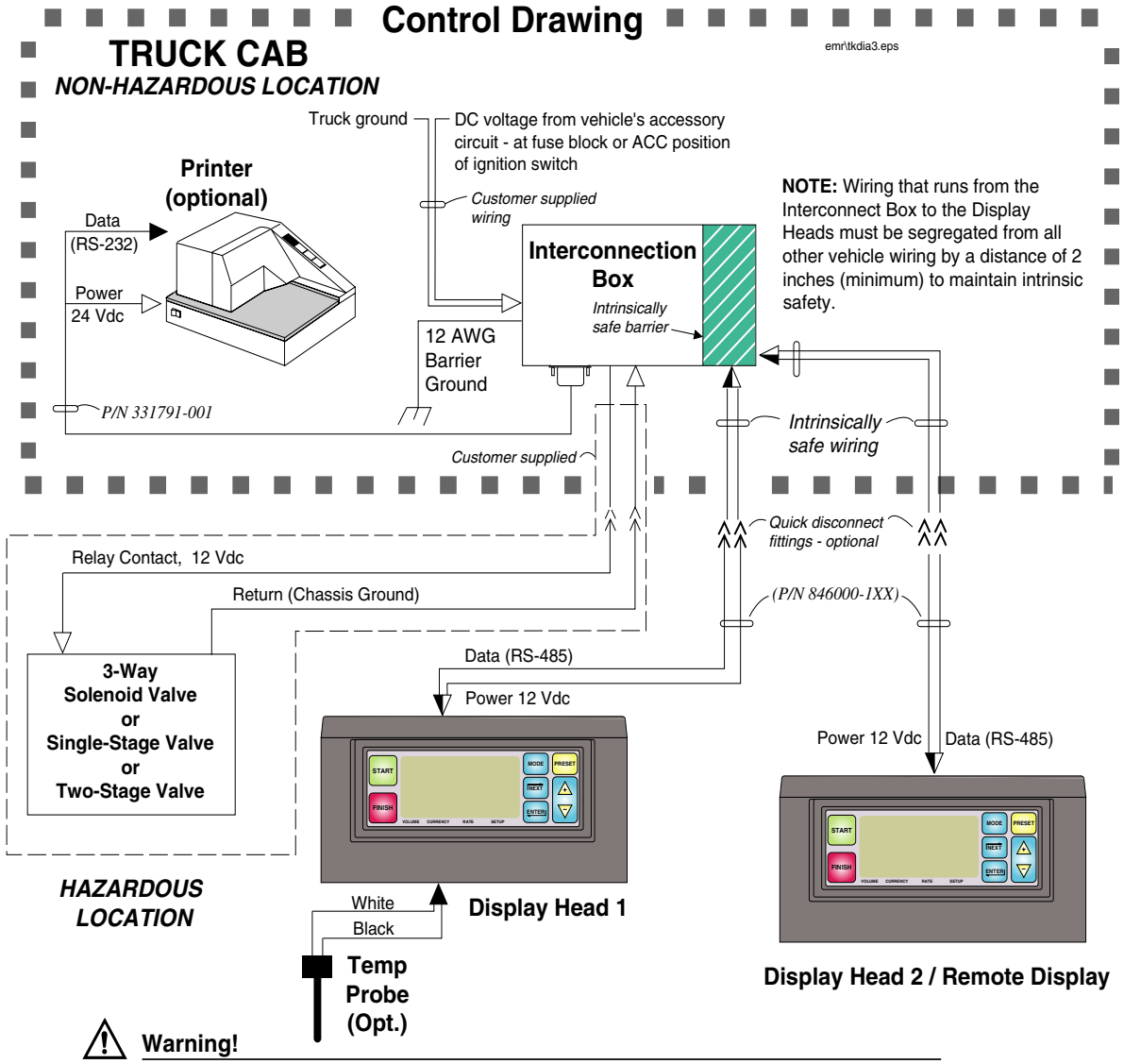
To ensure proper installation, operation, and continued safe use of this product:

1. **Read and follow all instructions in this manual, including all safety warnings.**
2. **Have equipment installed by a contractor trained in its proper installation and in compliance with all applicable codes including: the National Electrical Code; federal, state, and local codes; and other applicable safety codes.**
3. **Operate this equipment in accordance with the instructions in this manual.**
4. **Do not modify or use service parts other than those provided by Veeder-Root. Substitution of components may impair intrinsic safety.**

EMR^3 Truck Installation

The installation of the EMR^3 System can be broken down into three steps; installing the Display Head, installing the IB, and installing the optional printer.

Figure 1 shows a block diagram of a truck mounted EMR^3 system with optional Remote Display.


Control Drawing
emr\tkdia3.eps
TRUCK CAB
NON-HAZARDOUS LOCATION
Truck ground
DC voltage from vehicle's accessory circuit - at fuse block or ACC position of ignition switch
Printer (optional)
Data (RS-232)
Power 24 Vdc
Customer supplied wiring
Interconnection Box
Intrinsically safe barrier
NOTE: Wiring that runs from the Interconnect Box to the Display Heads must be segregated from all other vehicle wiring by a distance of 2 inches (minimum) to maintain intrinsic safety.
12 AWG Barrier Ground
P/N 331791-001
Customer supplied
Intrinsically safe wiring
Quick disconnect fittings - optional
(P/N 846000-1XX)
Relay Contact, 12 Vdc
Return (Chassis Ground)
Data (RS-485)
Power 12 Vdc
3-Way Solenoid Valve or Single-Stage Valve or Two-Stage Valve
HAZARDOUS LOCATION
Power 12 Vdc
Data (RS-485)
White
Black
Temp Probe (Opt.)
Display Head 1
Display Head 2 / Remote Display

Warning!

The following information is for general reference and is not intended to replace recommended National Electric Code (NEC) procedures. It is important for the installer to understand that wiring located in Class I, Group D, Division 1 and 2 installations shall comply with the latest appropriate articles found in the National Electric Code (NFPA 70).

Figure 1. Example EMR^3 Truck Installation

Installation Procedures - Fuel Oil Truck Application

Follow the installation procedures below for your particular EMR^3 approved Flow Meter Installation.

Liquid Controls Flow Meter Installation

Table 1 lists the parts included in the EMR^3 approved adaptor kit.

Table 1. Display Head-to-Liquid Controls Adaptor Kit 846000-006

Item	Qty	V-R P/N
Wire - Sealing 24 ” (610 mm) LG	1	011853-285
Seal - Lead	1	044602-005
Shaft - Drive Short L.C.	1	328907-001
Groove Pin - 0.063 D x 0.375	1	510162-001
Coupling - Double End Short	1	331413-001
Coupling - Double End Long	1	331413-002

Installation Procedure

1. Remove and put aside the four mounting bolts holding the meter register assembly to the meter adaptor mounting flange. Remove the existing mechanical register.
2. Notice the type of coupling connecting the register/preset to the meter adaptor input shaft.
3. Look at the base of the Display Head. The projecting encoder shaft has a small cotter pin inserted in it to keep it from sliding up into the Display Head, and a washer (V-R Part No. 011071-933 - 0.194” x 0.010” x 0.690” [4.93 x 0.25 x 17.53 mm]). Remove the cotter pin.

   Remove an identical coupling from the installation kit and attach it with an enclosed groove pin to the encoder input shaft projecting from the base of the Display Head (make sure that you support the encoder shaft when inserting the pin to avoid damaging the shaft).

Important ☞ Make sure the washer is on the shaft between the end of the coupling and the Display Head.

4. Remove the four cover bolts of the Display Head and lift off the cover. Put the cover and bolts aside.
5. Remove the existing calibrator device and replace with the appropriate length coupling: V-R Part No. 331413-001 or 331413-002.
6. Orient the encoder input shaft coupling so that it ‘mates’ with the meter adaptor input shaft, then lower the Display Head onto the meter adaptor mounting flange.
7. Rotate the Display Head on the meter adaptor mounting flange until the display is facing in the desired direction and check to see that the four meter adaptor flange mounting holes align with four of the eight tapped (1/4 - 28 UNF-2B threads) mounting holes in the base of the Display Head’s housing. You may have to rotate the Display Head right or left a little to line up the four holes. Replace the four mounting bolts and tighten them securely.
8. If you have the optional temperature probe, remove the existing temperature probe with the mechanical register and replace it with the Display Head temperature probe.

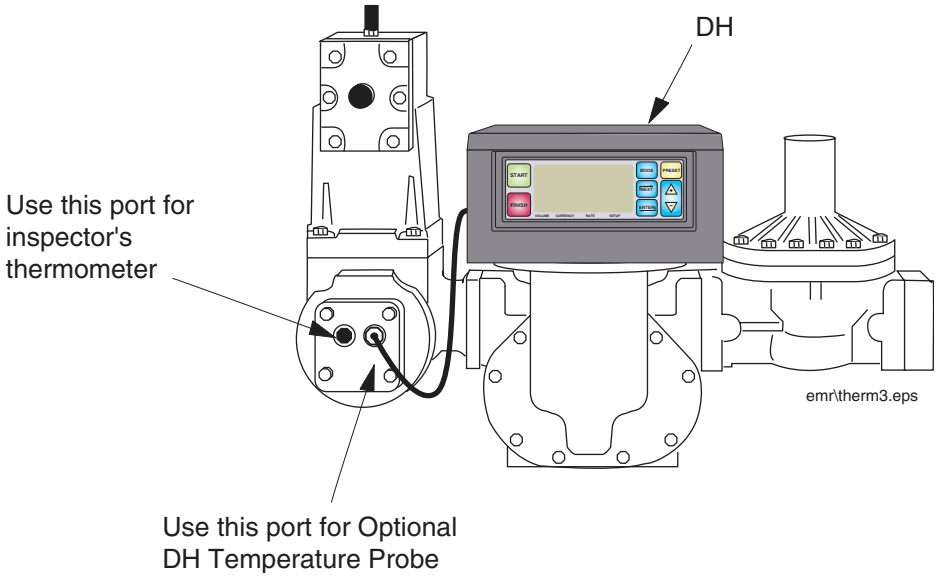


Figure 2. Example of Temperature Probe Installation

Tokheim, Daniels & Donovan Flow Meter Installation

Table 2 lists the parts included in the EMR^3 approved kit. In addition to the "Installation Procedure" on page 5, see Figure 3 on page 7, Figure 4 on page 8, and Figure 5 on page 9 for instructions on how to disassemble then reassemble the calibrator.

Table 2. Display Head-to-Tokheim, Daniels & Donovan Adaptor Kit 846000-004

Item	Qty	V-R P/N
Washer - 0.258 x 0.010 x 0.500	2	011071-325
Wire - Sealing 24" (610 mm) LG	1	011853-285
Seal - Lead	1	044602-005
Coupling - Slot 0.156 W	1	065004-010
Screw - 0.250-28 x 0.62 Hex	4	503615-001
Lockwasher - 0.256 x 0.02	4	510003-006
Groove Pin - 0.125 D x 0.750 T	1	510105-140
Groove Pin - 0.063 D x 0.781 T	1	510105-177
Retaining Ring	2	511810-001
Group - Adapter Shaft	1	331431-001

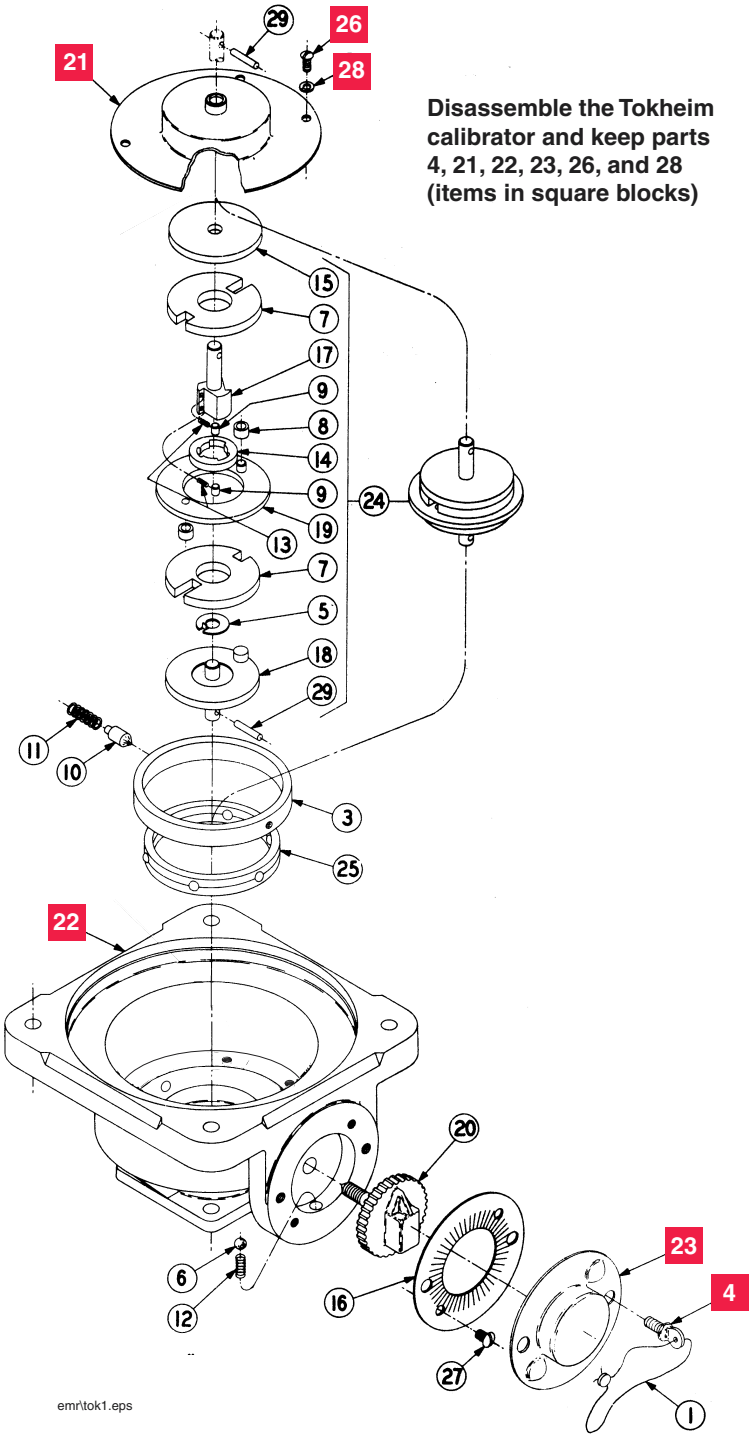


Figure 3. Disassembling the Tokheim Daniels, & Donovan Calibrator

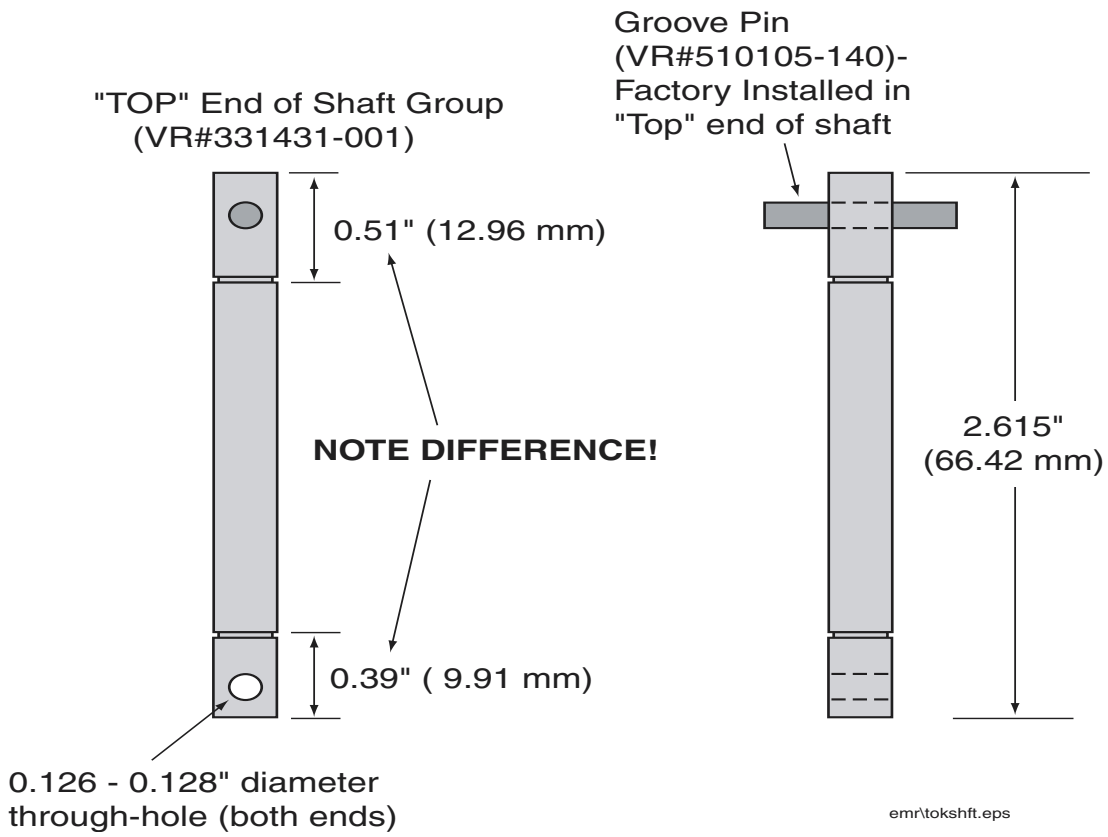


Figure 4. Adapter Shaft Group and Groove Pin for Tokheim, Daniels, & Donovan

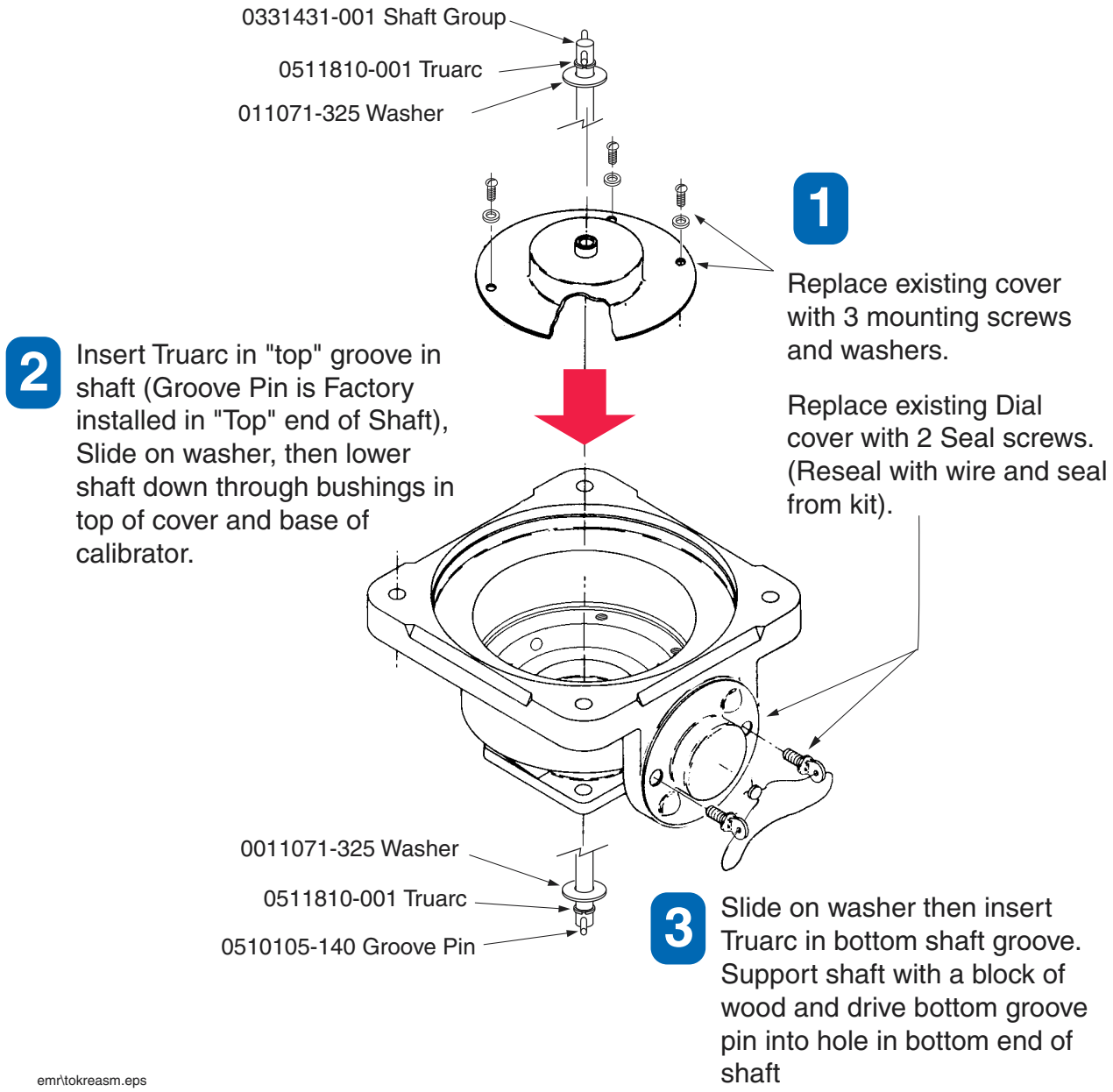

0331431-001 Shaft Group
0511810-001 Truarc
011071-325 Washer
1
Replace existing cover with 3 mounting screws and washers.
Replace existing Dial cover with 2 Seal screws. (Reseal with wire and seal from kit).
2
Insert Truarc in "top" groove in shaft (Groove Pin is Factory installed in "Top" end of Shaft), Slide on washer, then lower shaft down through bushings in top of cover and base of calibrator.
0011071-325 Washer
0511810-001 Truarc
0510105-140 Groove Pin
3
Slide on washer then insert Truarc in bottom shaft groove. Support shaft with a block of wood and drive bottom groove pin into hole in bottom end of shaft
emr\tokreasm.eps

Figure 5. Replacing the Tokheim Daniels, & Donovan Calibrator

Smith Flow Meter Installation

Table 3 lists the parts included in the EMR^3 approved adaptor kit. In addition to "Installation Procedure" on page 5, see Figure 6 on page 11, Figure 7 and Figure 8 on page 12, and Figure 9 on page 13 for instructions on how to disassemble then reassemble the calibrator.

Table 3. Display Head-to-Smith Meter Adaptor Kit 846000-005

Item	Qty	V-R P/N
Wire - Sealing 24" (610 mm) LG	1	011853-285
Seal - Lead	1	044602-005
Coupling - Slot 0.130 W	1	065004-005
Screw - 0.250-28 x 0.62 Hex	4	503615-001
Lockwasher - 0.256 x 0.02	4	510003-006
Groove Pin - 0.078 D x 0.562	1	510114-001
Groove Pin - 0.063 D x 0.781	1	510105-177
Group - Short Shaft	1	331433-001
Group - Long Shaft	1	331433-002

Remove cover and discard all inner parts.
Keep only parts followed by an asterisk*

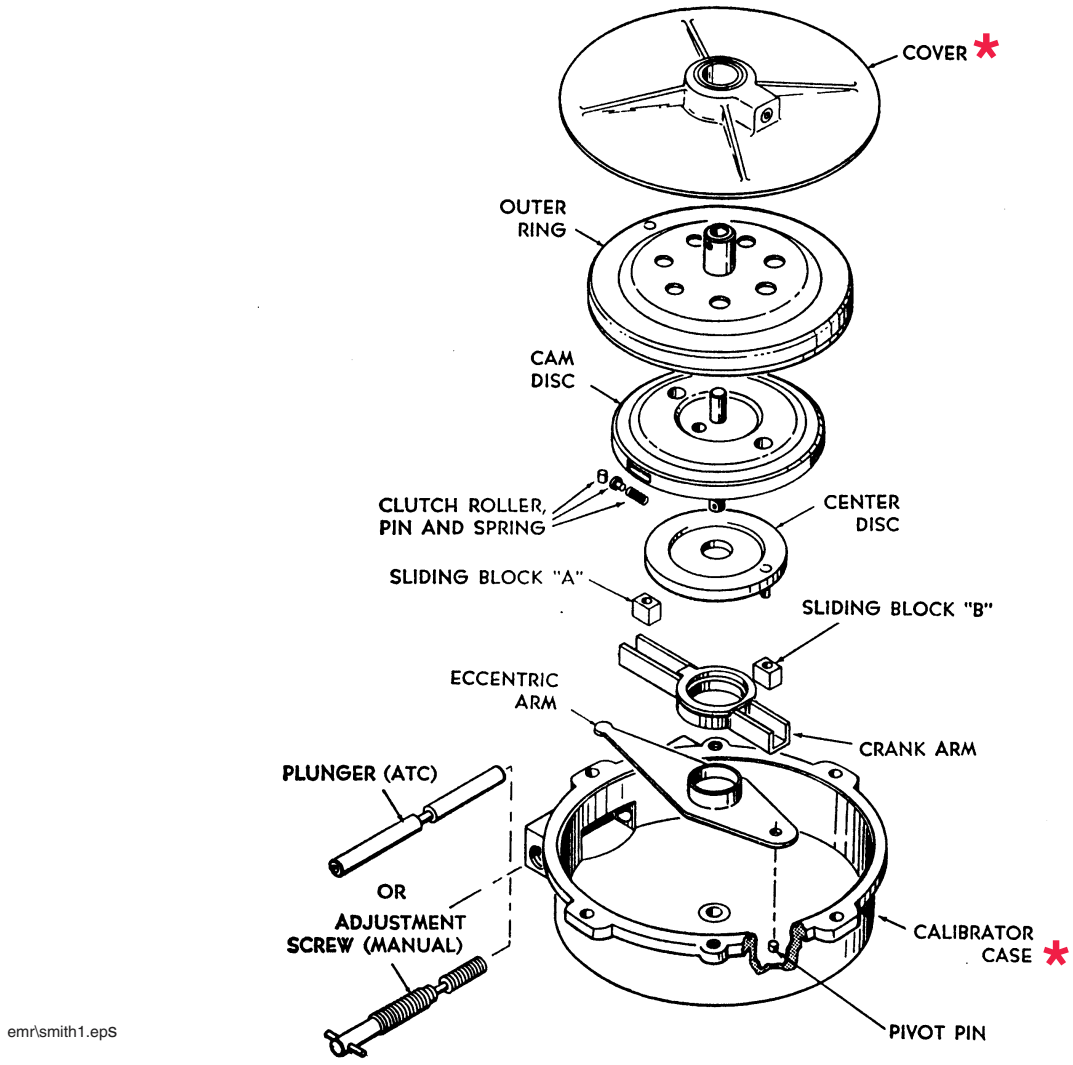


Figure 6. Disassembling the Smith Meter Calibrator

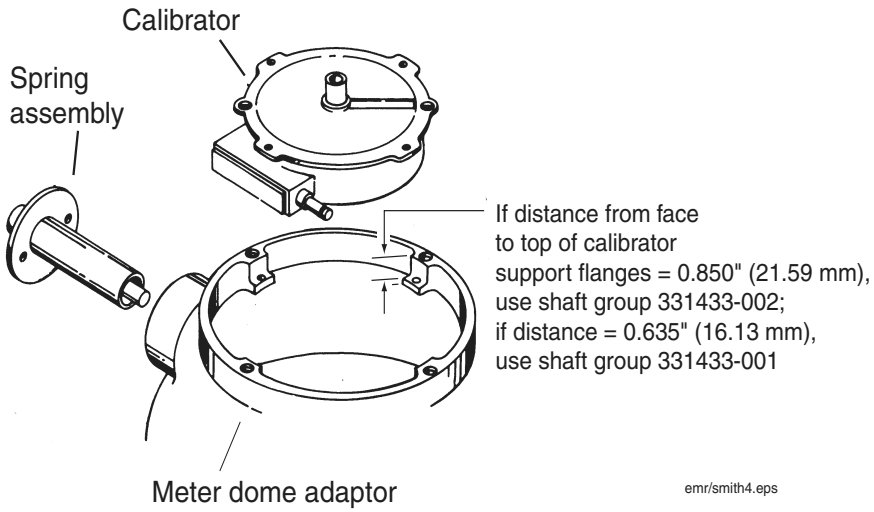
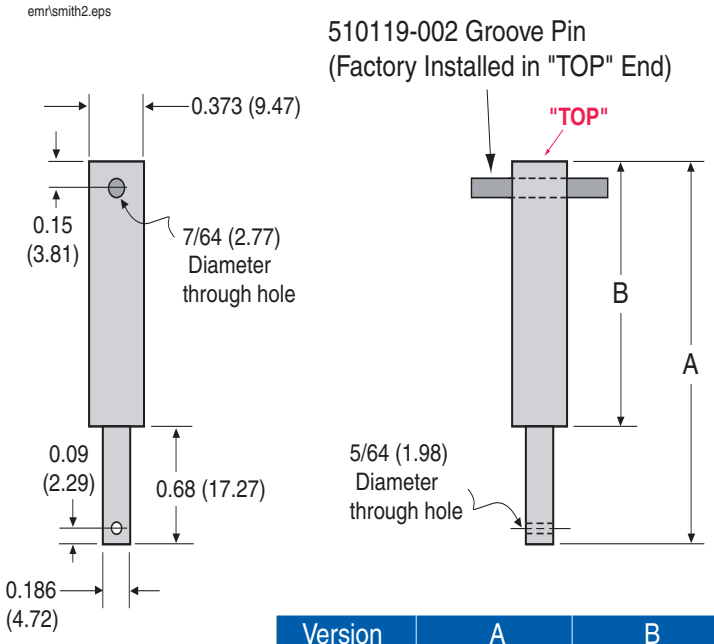

Calibrator
Spring assembly
If distance from face to top of calibrator support flanges = 0.850" (21.59 mm), use shaft group 331433-002; if distance = 0.635" (16.13 mm), use shaft group 331433-001
Meter dome adaptor
emr/smith4.eps

Figure 7. Calibrator, Spring Assembly, and Meter Dome Adapter



Version	A	B	Shaft Group
Short Shaft	2.208 (56.08)	1.528 (38.81)	331433-001
Long Shaft	2.423 (61.54)	1.743 (44.27)	331433-002

Figure 8. Adapter Shaft and Groove Pin for Smith Meter

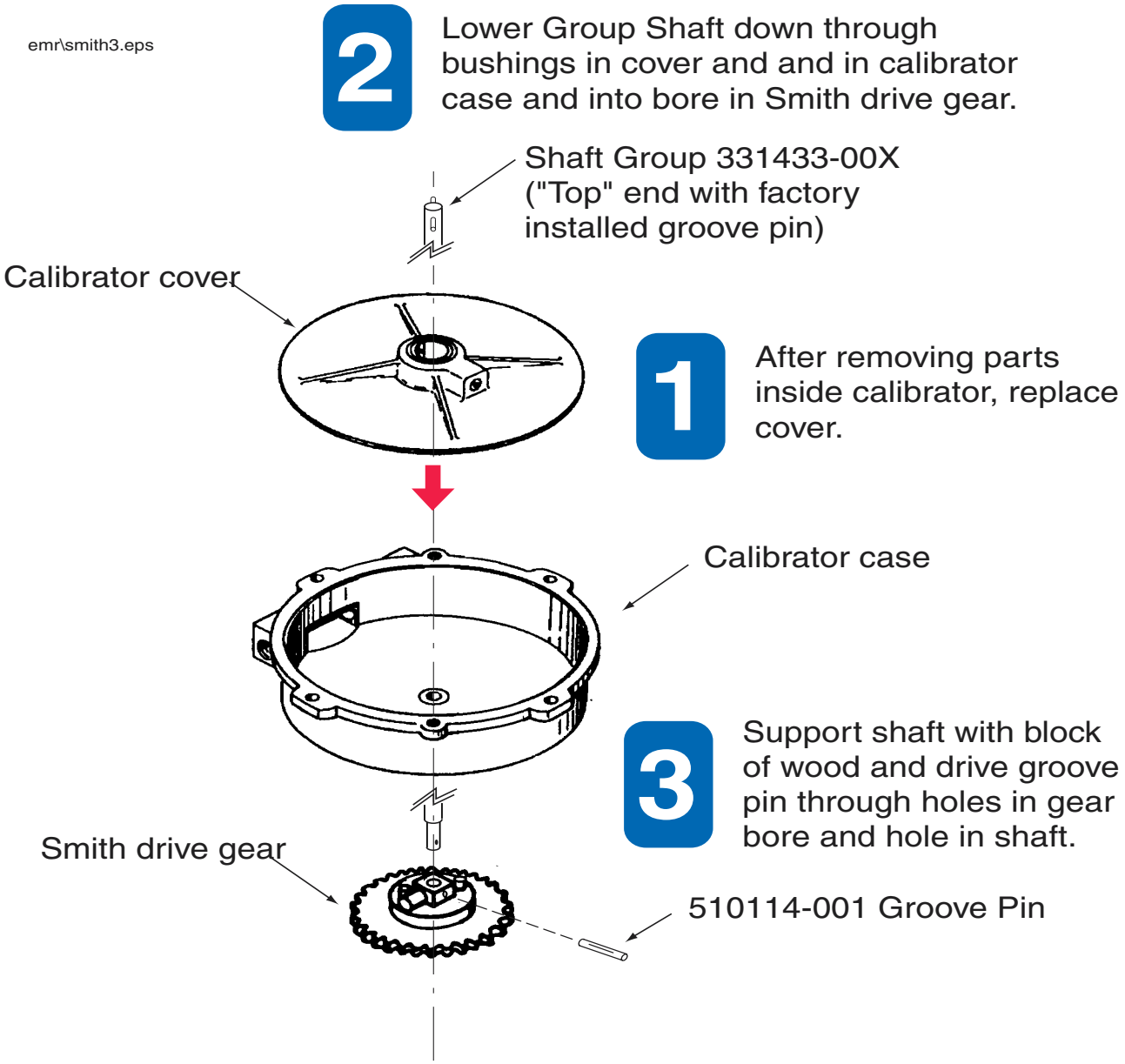

emr\smith3.eps
2
Lower Group Shaft down through bushings in cover and and in calibrator case and into bore in Smith drive gear.
Shaft Group 331433-00X ("Top" end with factory installed groove pin)
Calibrator cover
1
After removing parts inside calibrator, replace cover.
Calibrator case
3
Support shaft with block of wood and drive groove pin through holes in gear bore and hole in shaft.
Smith drive gear
510114-001 Groove Pin

Figure 9. Reassembling the Smith Meter Calibrator

Neptune Propane Flow Meter Installation

Follow the installation procedures for your particular EMR3 approved Flow Meter Installation.

Neptune Flow Meter With Temperature Compensation

Table 4. Display Head-to-Neptune With Temp. Comp. Adaptor Kit 846000-008

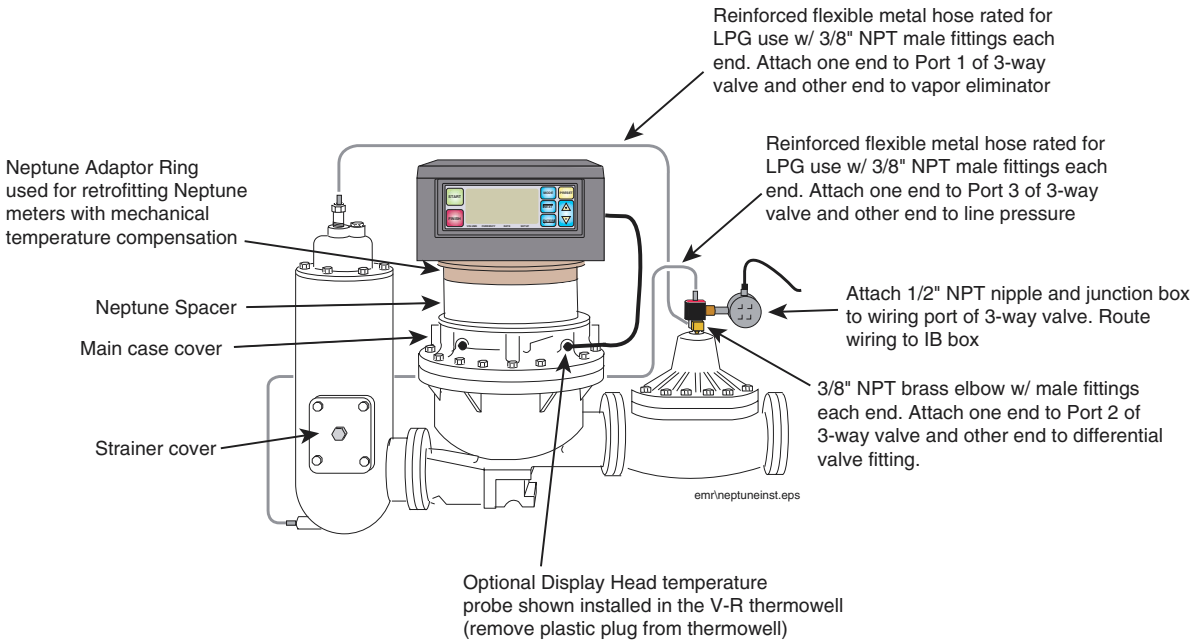
Item	Qty	V-R P/N
Neptune Adaptor Ring	1	328159-003
Input Shaft	1	331656-001
Screws - 1/4-20 x 3/4”	4	510500-325
Screws - 1/4-20 x 5/8”	4	503615-001
Seal Lead	1	044602-005
Seal Wire	1	011853-285
Groove Pin	1	510107-002
Lockwashers	8	510003-006
Washer - 0.010” thick	1	011071-929
Washer - 0.005” thick	1	011071-785
Truarc Retaining Ring	1	511816-001
Coupling	1	323372-001
Groove Pin	1	510107-002

Neptune Flow Meter Without Temperature Compensation

Table 5. Display Head-to-Neptune W/o Temp. Compensation Adaptor Kit 846000-009

Item	Qty	V-R P/N
Neptune Spacer	1	323672-001
Stud	2	036788-005
Lockwasher	2	510023-001
Nut	2	511041-001
Screw-Seal (Meter Register Mounting)	4	503615-001
Lockwasher	4	510003-006
Seal Wire	1	011853-285
Seal Lead	1	044602-005
Coupling Group (w/Groove Pin)	1	323372-001
Groove Pin	1	510107-002

1. Remove and put aside the four mounting bolts holding the meter register assembly to the meter adaptor mounting flange. Remove the existing mechanical register.
2. Remove the cover, P/N 86665-000, from the mechanical register's lever arm assembly.
3. Remove the lever arm assembly from the meter. Keep the locking pin (P/N 86661-001).
4. Remove and put aside the four mounting bolts holding the meter register assembly to the spacer (these bolts may be needed for reassembly).
5. Remove the mechanical meter register and the (4) temperature compensator bolts. Take out the compensator gear assembly.
6. Keep the main case cover (P/N 400081-002) and the spacer (P/N 86711-000) in place. Clean off the top of the spacer.
7. Set the V-R Adaptor (P/N 328159-003) on top of the spacer and mount it using (4) bolts (P/N 510500- 325) with lockwashers [see Figure 10].


Reinforced flexible metal hose rated for LPG use w/ 3/8" NPT male fittings each end. Attach one end to Port 1 of 3-way valve and other end to vapor eliminator
Reinforced flexible metal hose rated for LPG use w/ 3/8" NPT male fittings each end. Attach one end to Port 3 of 3-way valve and other end to line pressure
Neptune Adaptor Ring used for retrofitting Neptune meters with mechanical temperature compensation
Neptune Spacer
Main case cover
Strainer cover
Attach 1/2" NPT nipple and junction box to wiring port of 3-way valve. Route wiring to IB box
3/8" NPT brass elbow w/ male fittings each end. Attach one end to Port 2 of 3-way valve and other end to differential valve fitting.
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Optional Display Head temperature probe shown installed in the V-R thermowell (remove plastic plug from thermowell)

Figure 10. Example of Temperature Probe Installation in Main Case Cover

8. Notice the type of coupling connecting the register/preset to the meter adaptor input shaft.
9. Remove the four cover bolts of the Display Head and lift off the cover. Put the cover and bolts aside.
10. Look at the base of the Display Head. Locate the Encoder Drive Spring. Pull the Encoder Drive Shaft spring off of the shaft in the base of Display Head.
11. The end of this shaft projecting out of the bottom of the Display Head has a small cotter pin inserted in it to keep it from sliding up into the Display Head and a washer (P/N 011071-933). Remove this cotter pin. Remove the shaft and washer (you will reuse this washer).
12. Get the 4" (101.60 mm) long input shaft, the 0.10" and 0.005" thick washers, the retaining ring, the groove pin, and the coupling from the installation kit. Assemble the new shaft, the 0.10"

washer you removed from the Display Head shaft in the previous step, the 0.005” washer, and the retaining ring in the Display Head base as shown in Figure 11. If the 0.10 - 0.015” endplay is exceeded, remove the retaining ring and replace the 0.005” washer with the 0.010” washer.

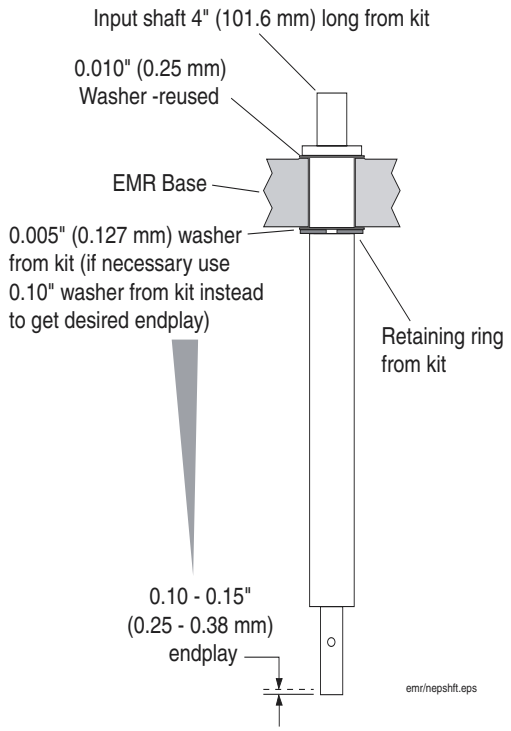


Figure 11. Assembling Neptune Adaptor Shaft Group to Display Head

13. With the end play within limits, get the coupling and groove pin from the kit and attach the coupling to the bottom of the input shaft with the pin as shown in Figure 12.

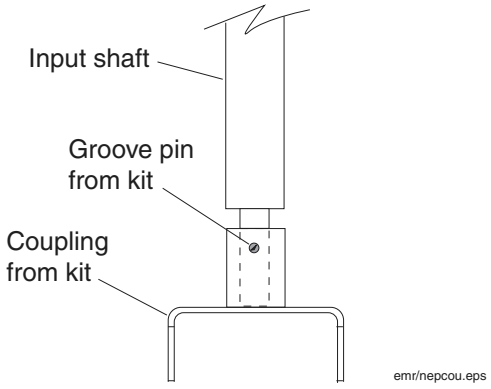


Figure 12. Attaching Coupling to Neptune Adaptor Shaft

14. Orient the encoder input shaft coupling so that it ‘mates’ with the meter adaptor input shaft, then lower the Display Head onto the meter adaptor mounting flange.

15. Rotate the Display Head on the meter adaptor mounting flange until the display is facing in the desired direction and check to see that the four meter adaptor flange mounting holes align with four of the eight tapped (1/4 - 28 UNF-2B threads) mounting holes in the base of the Display Head's housing. You may have to rotate the Display Head right or left a little to line up four holes. Use (4) hex bolts with the seal wire hole in the bolt head (P/N 503615-001) to mount the Display Head to the adaptor.
16. If a mechanical (or other) temperature compensator is being replaced, remove the temperature sensing element from the thermowell.

Important ☞ Mechanical temperature compensation must be disabled or else EMR^3 performance/calibration will be poor.

17. Reference section of the EMR^3 Setup and Operation manual for Temperature Probe Verification.
18. Emergency Stop Switch (ESS) Switch
    a. If you have the optional ESS switch, you should install it on the truck near the Display Head. There are two 0.181" (4.6 mm) diameter mounting holes in the ESS switch base. Also, you will need a length of 2-wire cable to connect the ESS switch to the Display Head (see Figure 13),
    b. Unscrew the yellow top half of the ESS switch and put it and the gasket aside. Push out the bottom knockout in the black bottom half of the switch housing. Mount the bottom half of the switch to the truck in a place that will be quickly accessible during a delivery, using (2) 0.157" (4 mm) screws. Screw the cord grip fitting from the kit into the knockout in the switch's bottom half. Loosen the cord grip nut/bushing and push one end of the 2-wire (black and white) cable through the cord grip fitting and into the switch housing.
    c. Connect the black wire of the cable to the #4 terminal of the ESS switch assembly and the white wire of the cable to the #3 terminal of the ESS switch assembly. Tighten the cord grip nut to seal the cable.
    d. Position the ESS switch's yellow top half on the mounted black half, being careful that the gasket is in place. Screw in the four screws in the yellow half of the housing.

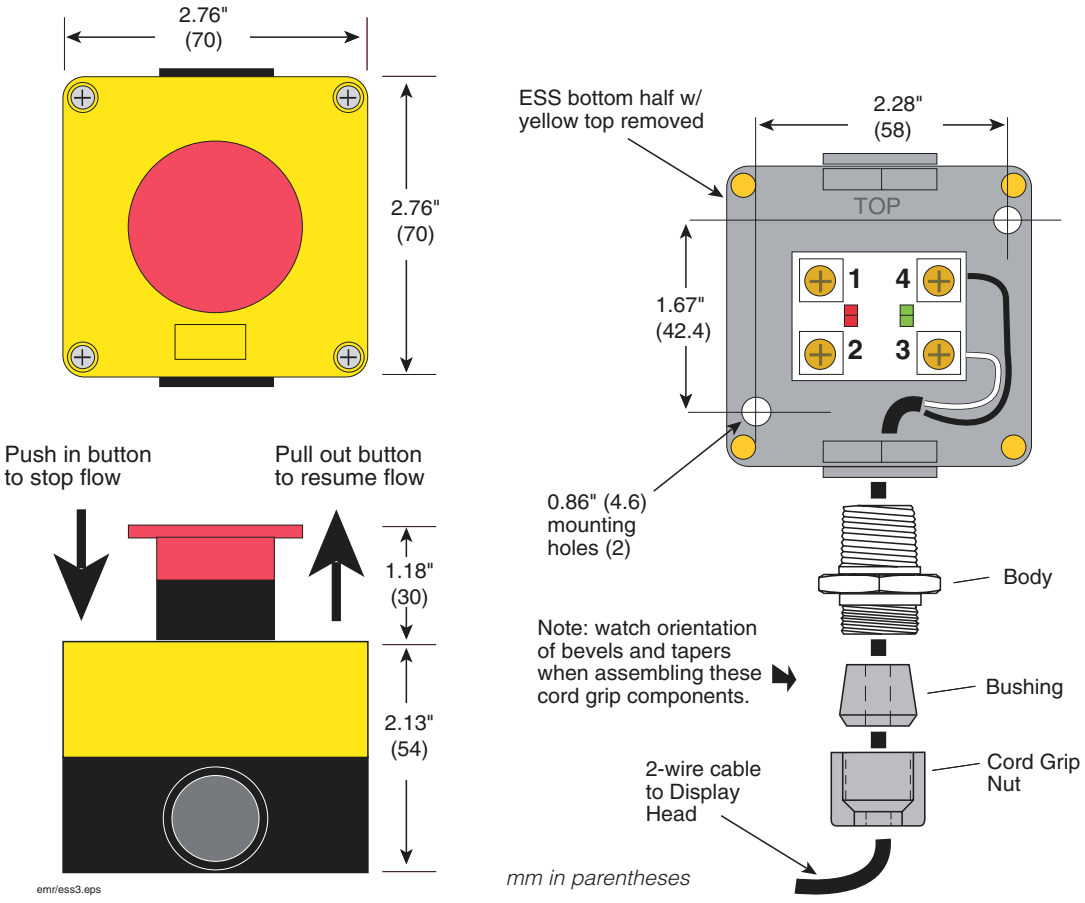


Figure 13. Emergency Stop Switch Mounting and Wiring Diagram

Wiring the Display Head

1. With the Display Head cover still off, remove the nut and bushing from the right-side panel cord grip connector.
2. Slide the cord grip nut and then the bushing over the IB cable leads. Pull enough cable through so that the leads reach the terminal block on the Display Assembly and can be tie wrapped to the Pulse Encoder mounting base as shown in Figure 14. Slide the tapered end of the bushing into the cord grip, then screw on the cord grip nut and tighten securely.
3. Attach the IB cable to the Terminal Block as shown in Figure 14. Attach the drain wire of the IB cable to a grounding lug on the Pulse Encoder mounting base as shown in Figure 14.

   When stripping wire for terminal block connections, be careful not to nick the individual strands. Also, be sure to tighten each terminal so the wire can not be pulled out. A failure to follow either of these instructions can result in signal loss and faulty operation.
4. If you have the optional temperature probe and/or ESS switch, remove the lower cord grip nut and slide it, then the tapered bushing, over the temperature probe and/or ESS switch cable(s). Pull enough cable through so that the leads reach the terminal block on the Display Assembly and can be tie wrapped to the Pulse Encoder mounting base as shown in Figure 14. Slide the bushing into the cord grip and then screw the cord grip nut onto the cord grip and tighten securely.

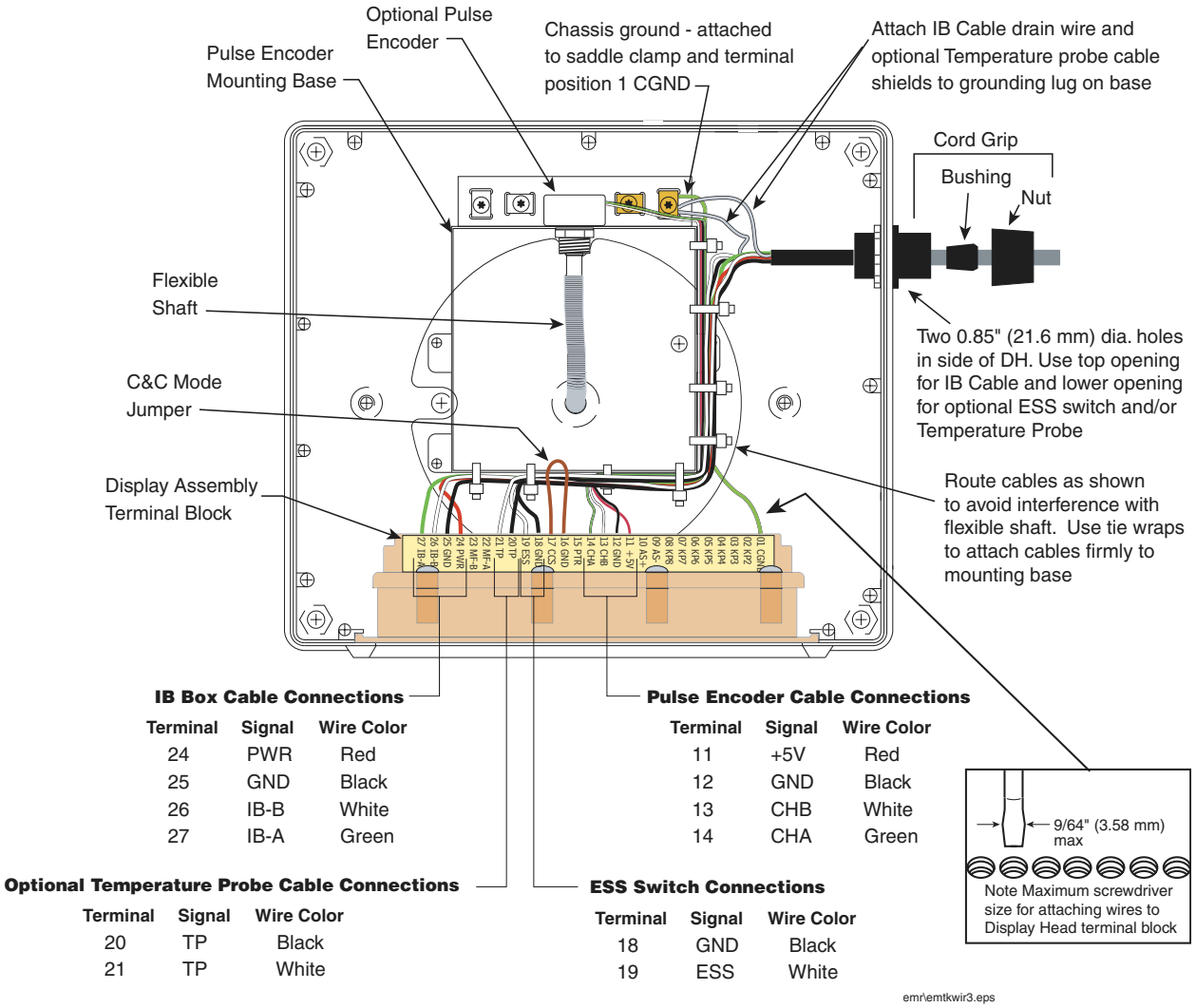
Attach the shield of the temperature probe cable to a grounding lug on the Pulse Encoder mounting base.

5. Attach each wire (no polarity) of the 2-connector Temperature Probe and/or ESS switch cable(s) as shown in Figure 14.
6. Tie wrap the IB, ESS switch, and temp probe (if installed) cables to the Pulse Encoder mounting base.
7. Replace the Display Head cover and screw in the four cover retaining bolts just enough to hold them in (the cover will be removed later for system calibration).
8. Using the tie wraps from the installation kit, attach the 4-wire cable from the Display Head to the Interconnect Box along the inside of the truck frame, to existing piping, or to the reel motor cable back to the cab. Avoid sharp bends and placements where vibration might wear through the cable. Allow ample cable length to compensate for tilt-cab trucks and to avoid putting additional stress on the assembly. Running the cable through a split loom or tubing will offer added protection from weather and abrasion. Use a rubber grommet or cord grip to line the hole where cable passes through truck cab wall or floor. Tractor-trailer installations will require detachable plugs, and either a separate tensioning device much like that used to protect air lines, or perhaps you can attach the cable to one of the existing air lines with tie wraps.

C&C Mode Switch Options

There are two C&C mode switch configurations:

1. A C&C wire jumper (see Figure 14) - standard configuration. To enter C&C mode, you remove one end of the jumper from its terminal, and you reconnect it when finished.
2. A optional C&C corner switch assembly which fits into a corner of the Display Head's housing (V-R #846000-018). To enter C&C mode, you remove the corner bolt of the Display Head's cover that presses against the switch actuator lever, and you replace the bolt when finished (see Figure 15).


Optional Pulse Encoder
Pulse Encoder Mounting Base
Chassis ground - attached to saddle clamp and terminal position 1 CGND
Attach IB Cable drain wire and optional Temperature probe cable shields to grounding lug on base
Cord Grip
Bushing
Nut
Flexible Shaft
C&C Mode Jumper
Display Assembly Terminal Block
Two 0.85" (21.6 mm) dia. holes in side of DH. Use top opening for IB Cable and lower opening for optional ESS switch and/or Temperature Probe
Route cables as shown to avoid interference with flexible shaft. Use tie wraps to attach cables firmly to mounting base
9/64" (3.58 mm) max
Note Maximum screwdriver size for attaching wires to Display Head terminal block
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IB Box Cable Connections

Terminal	Signal	Wire Color
24	PWR	Red
25	GND	Black
26	IB-B	White
27	IB-A	Green

Pulse Encoder Cable Connections

Terminal	Signal	Wire Color
11	+5V	Red
12	GND	Black
13	CHB	White
14	CHA	Green

Optional Temperature Probe Cable Connections

Terminal	Signal	Wire Color
20	TP	Black
21	TP	White

ESS Switch Connections

Terminal	Signal	Wire Color
18	GND	Black
19	ESS	White

Figure 14. Display Head Cable Connections

Corner Mounted C&C Switch

Removal of corner bolt releases actuator lever of C&C switch allowing entry into C&C Mode

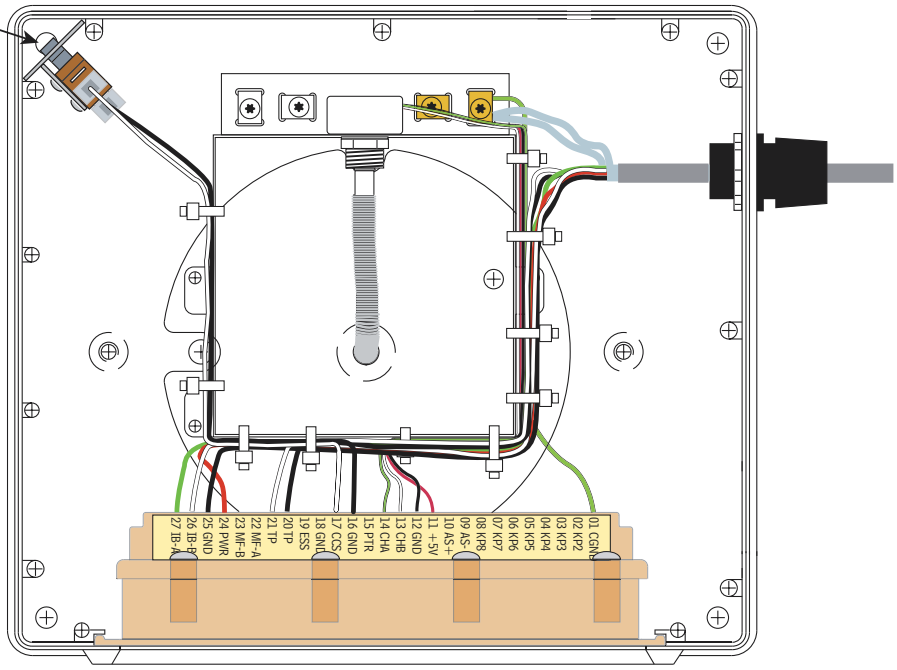

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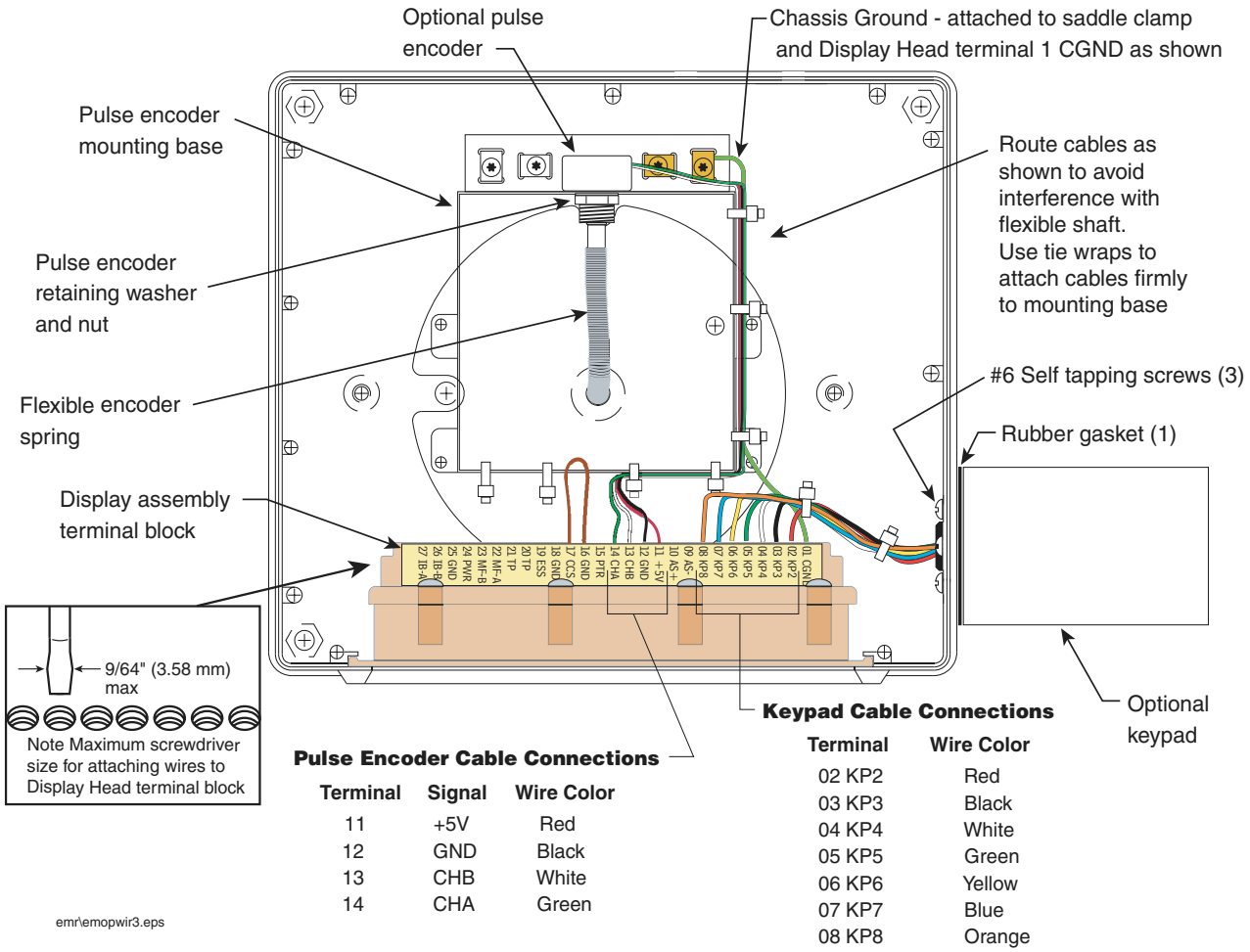
Figure 15. Optional C&C Mode Switch Configuration

Installing Optional Keypad Kit

Figure 16 shows the installation and wiring of the optional keypad. To attach the keypad housing mounting screws, you may have to pull/slide up the display assembly terminal block away from the Display Head. Insert the keypad wires through the center hole in the gasket, slide the gasket down against the keypad and align its three holes with the mounting holes in the keypad. Hold the keypad against the Display Head and screw in the 3 mounting screws as shown in Figure 16. Slide the terminal block down in place, and then make the wiring connections as shown in Figure 16.

Installing Optional Pulse Encoder Kit

Figure 16 shows the installation and wiring of the optional pulse encoder. Insert the pulse encoder into the hole in the bracket, install the washer, screw on the retaining nut, then make the wiring connections. Slide one end of the flexible encoder spring onto the shaft (from the mechanical meter) in the base of the Display Head and the other end onto the shaft of the pulse encoder (push the spring as far as it will go onto each shaft).


Optional pulse encoder
Chassis Ground - attached to saddle clamp and Display Head terminal 1 CGND as shown
Pulse encoder mounting base
Route cables as shown to avoid interference with flexible shaft. Use tie wraps to attach cables firmly to mounting base
Pulse encoder retaining washer and nut
#6 Self tapping screws (3)
Flexible encoder spring
Rubber gasket (1)
Display assembly terminal block
Optional keypad
9/64" (3.58 mm) max
Note Maximum screwdriver size for attaching wires to Display Head terminal block
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Pulse Encoder Cable Connections
Terminal Signal Wire Color
11 +5V Red
12 GND Black
13 CHB White
14 CHA Green
Keypad Cable Connections
Terminal Wire Color
02 KP2 Red
03 KP3 Black
04 KP4 White
05 KP5 Green
06 KP6 Yellow
07 KP7 Blue
08 KP8 Orange

Figure 16. Optional Pulse Encoder and Keypad Installations

Installing the Interconnection Box (IB)

The following information is for general reference and is not intended to replace recommended National Electric Code (NEC) procedures. It is important for the installer to understand that electrical equipment and wiring located in Class I, Division 1 and 2 installations shall comply with the latest appropriate articles found in the National Electric Code (NFPA 70) and other applicable code requirements.

1. The physical dimensions of the Interconnection Box (IB) are shown in Figure 17. The IB is installed in the truck's cab either under the seat, mounted on the wall inside the cab, mounted to the passenger side of the "dog house" in cab-over trucks, or mounted to a custom-made bracket that can also support the optional printer. Use four, 3/16" (4 mm) bolts to mount the IB to the mounting surface. In the event of limited access, the front cover of the IB can be completely removed rather than swung open, by removing four #15 Torx screws. Put the excess coils of cable under the seat or clamp them to the IB mounting stand.
2. Table 6 and Figure 18 show IB Power Side terminal wiring connections. Use Power Side knockouts (left side of IB) for all cables attaching to this terminal block.

3. Run the power cable from the truck fuse block or ignition switch to the IB. Clamp the power wire at suitable intervals between the power source and the IB.

   Before connecting the truck power wiring, verify the following:

   a. Electrical system has a negative ground.

   b. Battery terminals and cables are in good condition.

   c. Alternator current output is sufficient to supply EMR^3 System current requirement of 5 amperes.

   Attach the wire from truck ground to the Ground terminal of the Power Side terminal block. Also attach the wire from the truck's Accessory (ACC) circuit to the V+ terminal of the terminal block.

Important ☞ **CAUTION:** Always disconnect the IB box from truck power before welding on the truck.

4. Table 7 and Figure 18 show the IB intrinsically safe terminal wiring connections. Use Intrinsically Safe Side knockouts (right side of IB under cover) for Display Head cable entries. The drain wire in each Display Head cable must be connected to the adjacent chassis ground clamp.

5. For optional knockoff valve solenoid wires use either 2-conductor (V-R P/N 848100-2XX) or 3-conductor cable (V-R P/N 848100-3XX) - order in 100 ft. (30.48 m) increments. Wire each solenoid using V-R Suppressor Diode kit (V-R P/N 846000-022) as shown in Figure 19.

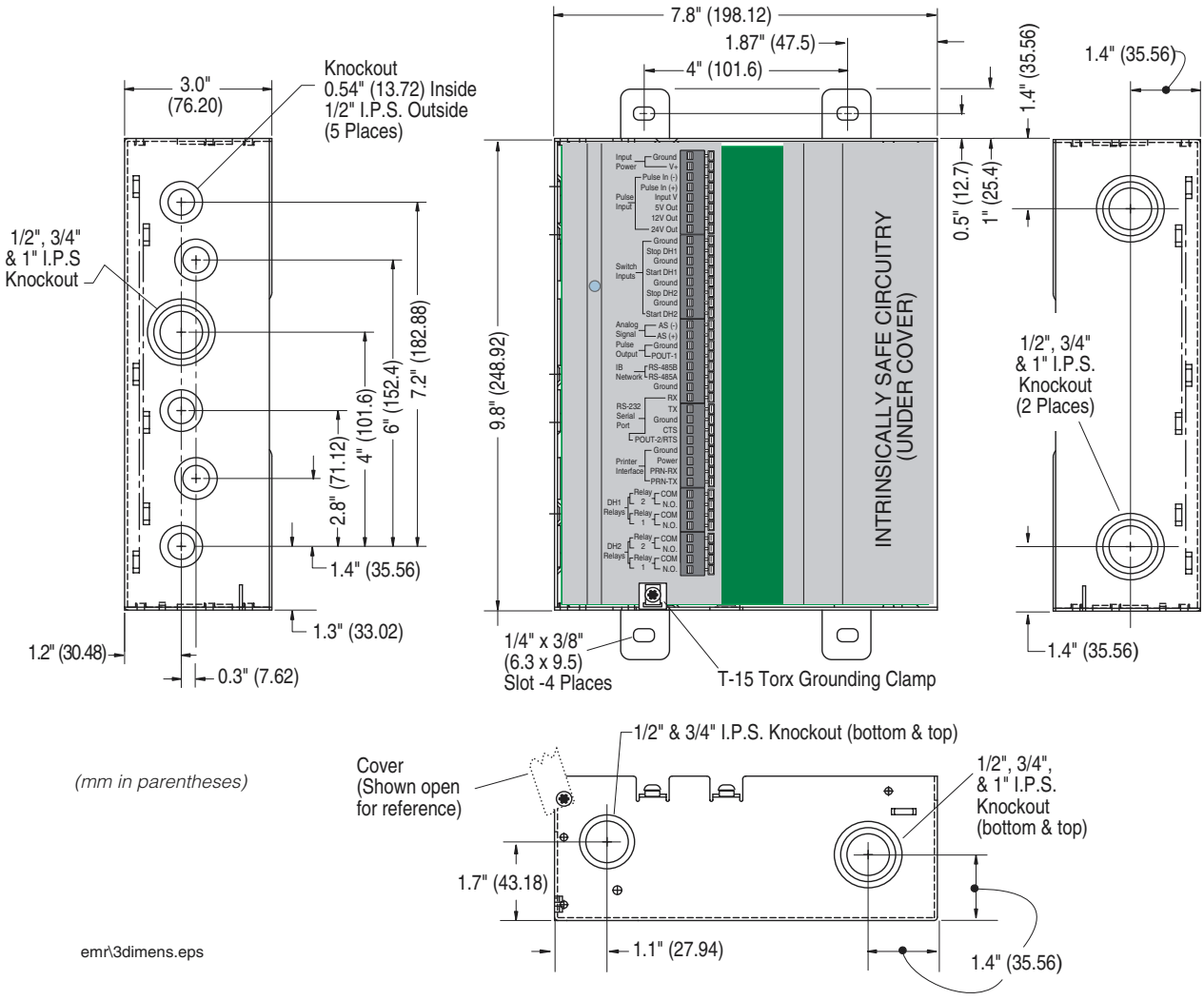


Figure 17. IB Physical Dimensions (shown with cover removed)

Table 6. Power Side Wiring for IB Box

Input		Terminal Label
Input Power		Ground
		V+
Pulse Input		Pulse In (-)
		Pulse In (+)
		Input Voltage
		5 V Out
		12 V Out
		24 V Out
Switch Inputs		Ground
		Stop DH1
		Ground
		Start DH1
		Ground
		Stop DH2
		Ground
		Start DH2
Analog Signal		AS (-)
		AS (+)
Pulse Output		Ground
		POUT -1
IB Network		RS-485 B
		RS-485 A
		Ground
Port 2 Slip Printer Roll Printer OBC AUX		RX
		TX
		Ground
		CTS
		POUT-2/RTS
Port 1 Slip Printer Roll Printer OBC AUX		Ground
		Power
		PRN-RX
		PRN-TX
DH 1 Relays	Relay 2	COM
		N.O.
	Relay 1	COM
		N.O.
DH 2 Relays	Relay 2	COM
		N.O.
	Relay 1	COM
		N.O.

For Port 2 assignments, see Figure 27 in Setup Manual.

For Port 1 assignments, see Figure 26 in Setup Manual.

Table 7. Intrinsically Safe Wiring for IB

Input	Terminal Label
Display Head 1	IB-A
	IB-B
	Gnd
	Pwr
Display Head 2 (or optional Remote Display)	IB-A
	IB-B
	Gnd
	Pwr

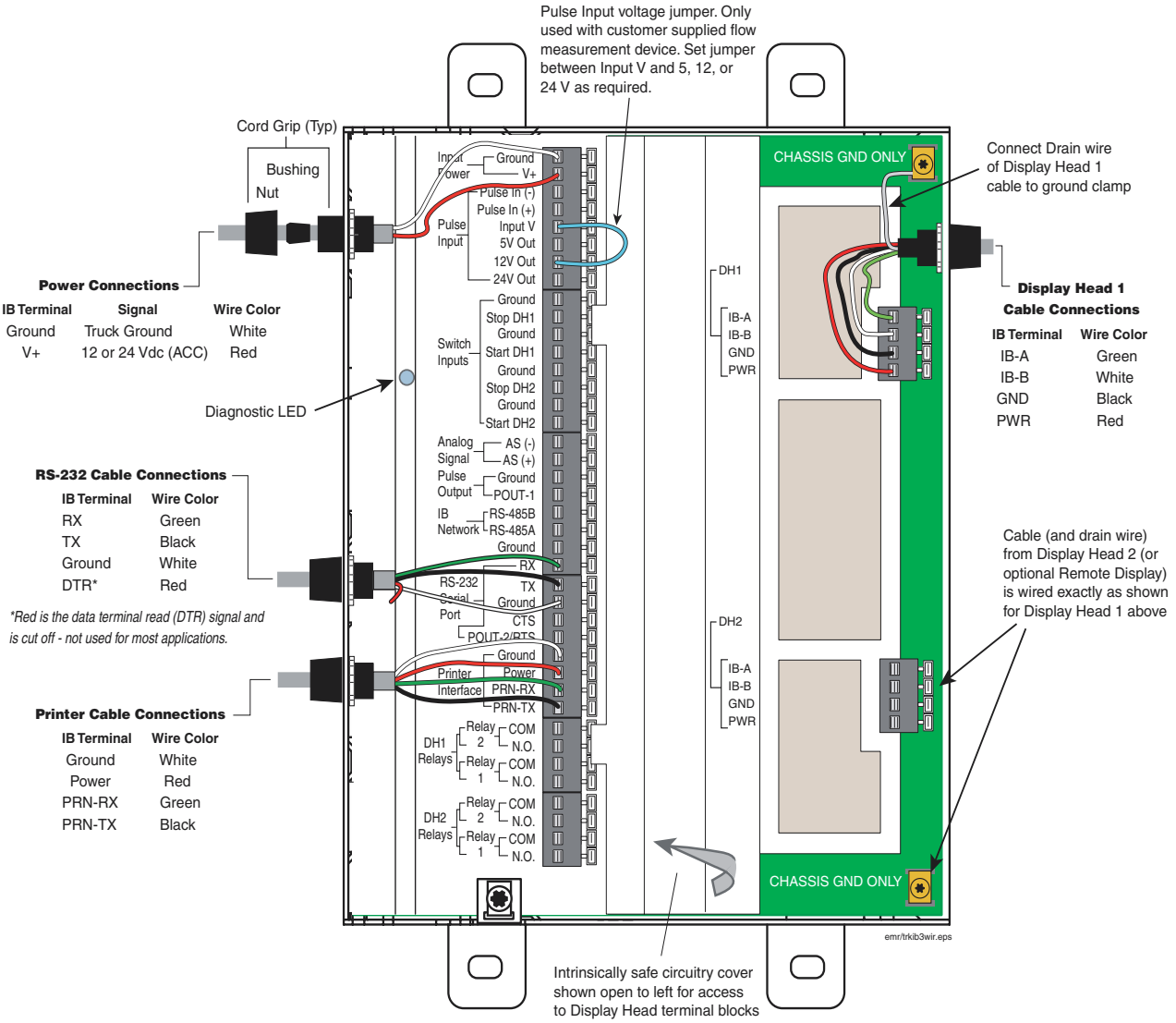


Figure 18. Wiring the Interconnection Box

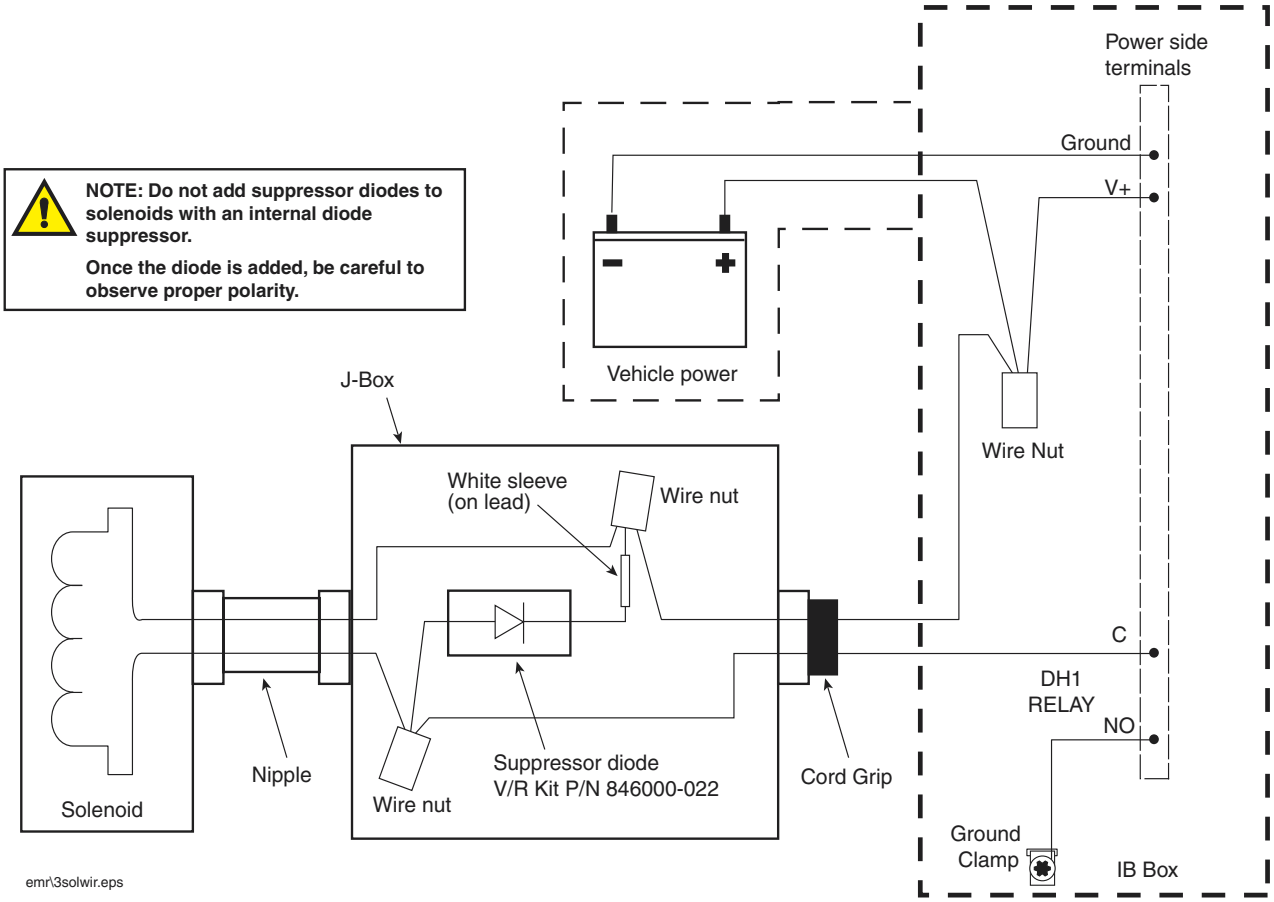


Figure 19. Wiring solenoid with external suppressor diode supplied by Veeder-Root - Typical

3-Way Safety Valve for Truck LP Gas Systems

The 3-Way Safety Valve is not intended for flow control or preset control.

⚠ WARNING

The Three-Way Safety Valve is installed and operated in the highly combustible environment of an LPG tank.

Fire or explosion resulting in serious injury or death could result if the equipment is improperly installed or modified.

1. **It is essential that you carefully read and follow the warnings and instructions in this manual to protect yourself and others from serious injury due to fire, explosion, or electrical shock. LPG systems shall be installed in accordance with the national standards and regulations that apply.**
2. **Comply with all federal, state, and local codes, and other applicable safety codes. All wiring must comply with standard electrical practices, the local authority, and the latest editions of the National Electrical Code (NFPA 70) and other applicable code requirements. All work on LPG systems must comply with NFPA 58, Liquefied Petroleum Gas Code and other applicable code requirements.**
3. **LPG tanks must be depressurized (drained) and free of liquid and combustible vapors before work begins.**
4. **Flow control valves connected to the EMR must either be Recognized Components or UL Listed. Flow control valves must be suitable for the intended application, i.e., gasoline, fuel oil, LPG, etc. For LPG applications, such as propane, each valve must have a minimum pressure rating of 350 psi.**

3-Way Valve Installation Kit

Important ☞ This kit does not contain conduit, hoses or fittings. The maximum operating pressure for the valve is 400 psi, with a temperature range of -40 to +185°F (-40 to +85°C).

Table 8. 3-Way Valve Installation Kit 846000-003

Item	Qty	V-R P/N
3-Way Solenoid Valve	1	576008-635
Cord Grips	3	331028-001
Cable Seal Kit	1	330020-098
2-Wire Cable	50 feet (15.24 m)	848100-250

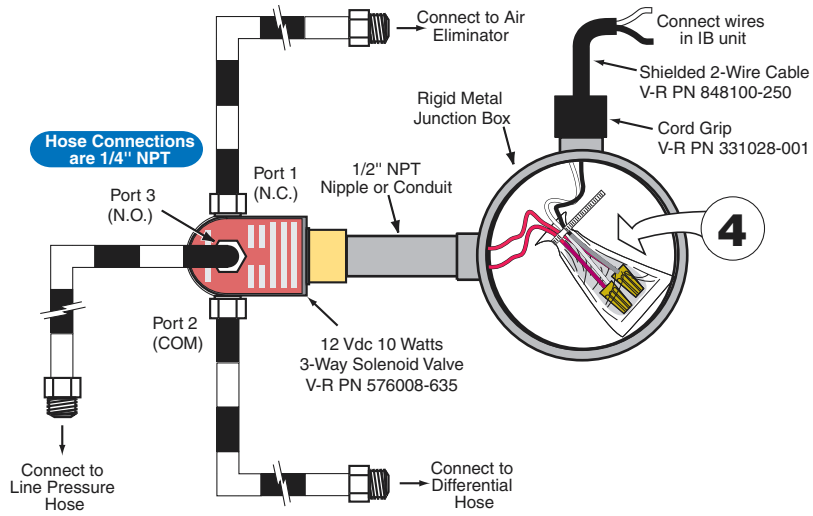
Installing The 3-way Valve

Important ☞ On the male pipe threads, use a pipe sealant when installing fittings or conduit to either the valve or the junction box.

1. On the valve, install a rigid metal conduit nipple in the threaded opening, provided for the solenoid wiring. Run the two red wires from the 3-way valve, through the nipple and into a metal junction box. Mechanically attach the valve/nipple combination to junction box as shown in Figure 20 on page 29. *Even though the 3-way valve will operate in any position, it will last longer and perform best if mounted vertically upright (port 3 up)*. Secure the junction box to the vehicle's frame.

2. Run a 2-wire shielded cable from the IB Box, located in the truck cab, to the 3-way valve junction box. Pass the cable through a cord grip fitting in one of the J-box openings. Cut off 1-inch (25.4 mm) of the cable's shield and jacket, then strip off 1/2-inch (12.7 mm) of each wire's insulation.
3. Using the wire nuts, connect the stripped wires from the IB box to the 3-way valve wires (step 1 in Figure 20). There is no polarity to the 3-way valve's wiring. Seal the wire nuts with epoxy sealant using one bag for both wire nut connections and place bag in junction box (Steps 2 & 3 in Figure 20).

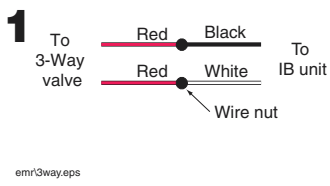
CAUTION: Epoxy sealant is irritating to eyes, respiratory system, and skin. Can cause allergic skin reaction. Contains: epoxy resin and cycloaliphatic epoxycarboxylate. Precautions: Wear suitable protective clothing, gloves, eye, and face protection. Use only in well ventilated areas. Wash thoroughly before eating, drinking, or smoking.

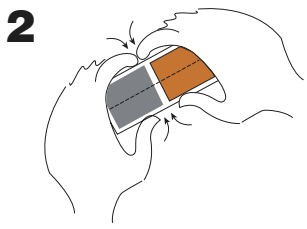

Connect to Air Eliminator
Connect wires in IB unit
Shielded 2-Wire Cable V-R PN 848100-250
Rigid Metal Junction Box
Cord Grip V-R PN 331028-001
Hose Connections are 1/4" NPT
Port 1 (N.C.)
1/2" NPT Nipple or Conduit
Port 3 (N.O.)
4
Port 2 (COM)
12 Vdc 10 Watts 3-Way Solenoid Valve V-R PN 576008-635
Connect to Line Pressure Hose
Connect to Differential Hose

Instructions:

NOTE: When temperature is below 50˚F (10˚C), keep resin in a warm place prior to mixing (e.g., in an inside pocket next to body).

1. Attach red wires from 3-way valve to black and white shielded wire from IB unit with wire nuts as shown in 1.
1. Open epoxy package, and remove resin pak.
2. Holding resin pak as shown in 2, bend pak along long length.
3. As shown in 3, firmly squeeze the RED SIDE of the resin, forcing it through the center seal and into BLACK SIDE.
4. Mix thoroughly to a uniform color by squeezing contents back and forth 25-30 times.
5. Squeeze mixed, warm resin into one end of bag and cutoff other end.
6. Slowly insert wiring connections into sealing pack until they fit snugly against the opposite end.
7. Twist open end of bag and use tie wrap to close it off, or wrap open end of bag with vinyl electrical tape (not included) and position the taped end up until the resin jells.
8. Place epoxy pack into junction box and screw on cover as shown in 4.





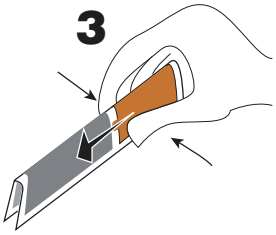


Figure 20. Connecting 3-Way Valve - Truck LP Gas Installations

4. Tighten the cable bushing nuts on the cord grip to ensure a watertight seal at the cable's entry.
5. Remove the protective closures from the 3-way valve ports. Connect a hose from line pressure to port 3 (normally open port) of the 3-way valve (see Figure 20). On some systems, line pressure is available at an opening in the vapor eliminator housing. Connect another hose from the 3-way valve's port 1 (normally closed port) to the air eliminator. Connect a third hose from the 3-way valve's port 2 (common port) to the differential valve.
6. At the IB Box, the 3-way valve solenoid to the C terminal of Display Head 1 Single Flow relay as shown in Figure 21

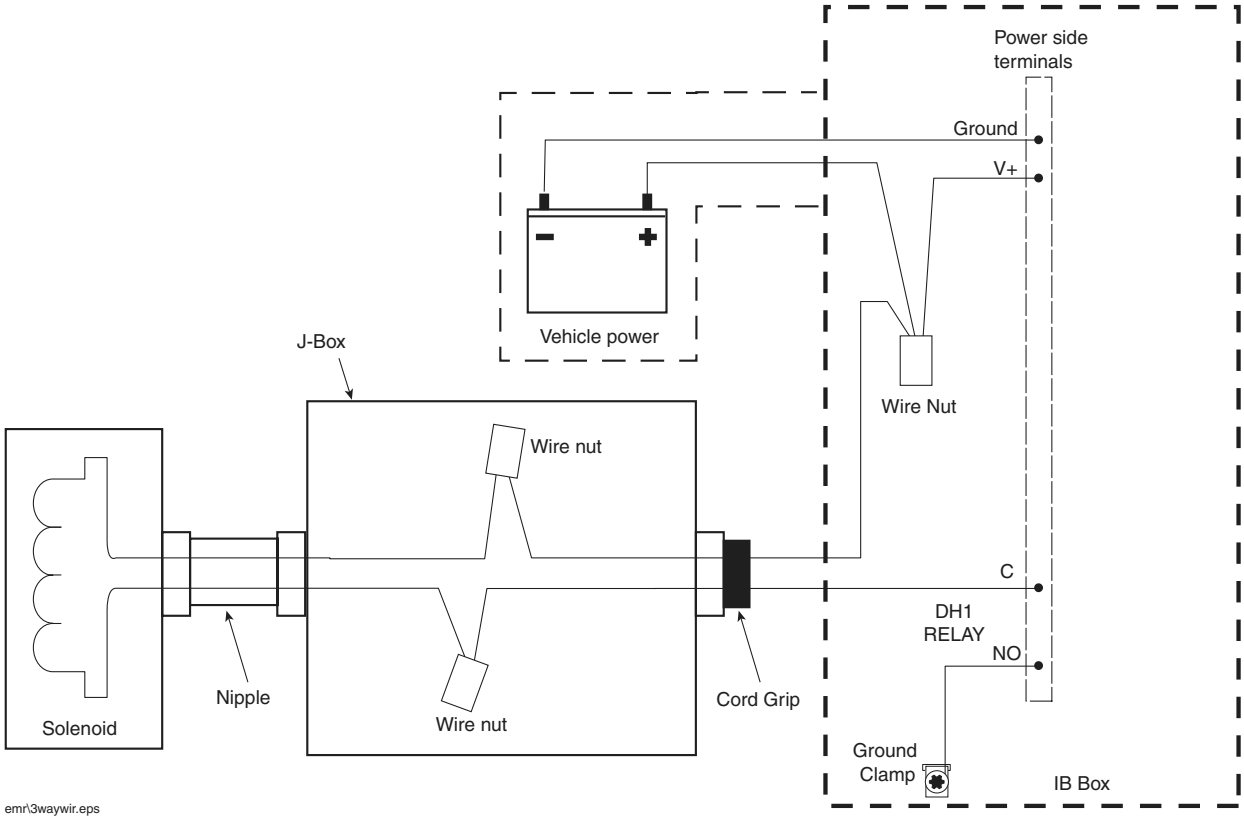


Figure 21. Connecting 3-Way valve to the IB Box

Installing the Temperature Probe (Optional)

7. Locate the thermowell in the metering system.

Important ☞

This must be a dual port thermowell to allow for installation of the temperature probe and to provide another port for an inspector's thermometer (see Figure 22).

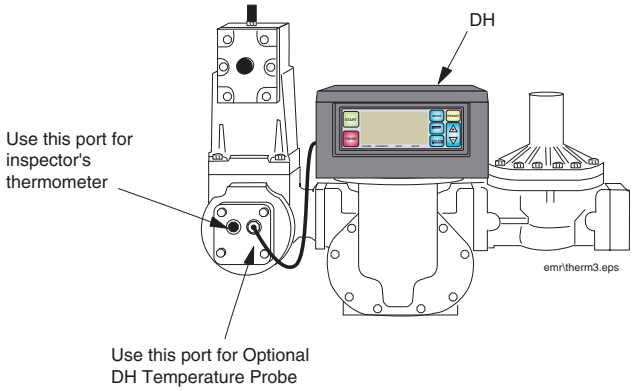


Figure 22. Typical Thermowell Installation

8. The thermistor should be verified prior to installation. Reference section "Temperature Measurement and Calibration" for verification procedure.
9. If a mechanical (or other) temperature compensator is being replaced, remove the temperature sensing element for the thermowell.

Important ☞ Mechanical temperature compensation must be disabled or else EMR^3 performance/calibration will be poor. It is highly recommended that the drywell be full at the time of probe installation for best results. Use a thermo-conductive liquid such as anti-freeze (ethelene glycol) or any non-freezing thermo-compound.

10. Install the temperature probe in the thermowell, while assuring that a second port remains available for an inspector's thermometer.

Important ☞ A second port may not be available on all meters. Check with the local inspector prior to using well (which may be required during flow meter proving).

Installing the Printer (Optional)

The Epson TM-295 dot matrix slip printer is attached with self-adhesive Velcro strips to a customer supplied mounting plate or printer stand located somewhere in the truck's cab.

Veeder-Root recommends that you purchase an off-the-shelf assembly on which to mount the printer. A suggested vendor for in-vehicle mounting hardware is Signal Measurement Corporation (SMC). You can phone them at (800) 527-1079, or write them at 12519 Wanda Lane, Magnolia, TX 77355, or contact their web site at *www.smc-corp.com* for pricing or more information.

Depending on your cab type (high cab or low cab) the following SMC printer stand parts should satisfy your printer mounting needs:

Table 9. High-Cab Installation*

Item	SMC P/N
Base plate	ZPLT-1
Pillar stack	PS12-A
Swivel stand	VMRU-9
Removable platform	VMI-L0

Table 10. Low-Cab Installation*

Item	SMC P/N
Base plate	ZPLT-1
Pillar stack	PS12-A
Removable platform	VMI-L0

*Use Loctite® 243 Threadlocker® on all printer stand mounting bolts. *(Loctite and 243 Threadlocker are registered trademarks of Loctite Corporation.)*

A power/data cable and three 2" x 3" (50 x 75 mm) Velcro strips are included in the printer kit. Figure 23 on page 32 shows the front panel lights and controls, and the rear panel connections to the TM-295 printer.

Figure 23 illustrates the TM-295 printer's address code setup for DIP switch 3 **(which must be set as shown or it will not work)** and suggested positions for the Velcro strips. Remove the rubber feet from the base of the printer to permit maximum contact between the Velcro strips and the mounting plate.

Attach the four wires of the printer power/data cable to the appropriate terminals of the Power Side terminal block in the IB (Figure 18 on page 26) and the DB-25 connector and the round power connector to the appropriate connectors on the rear of the printer.

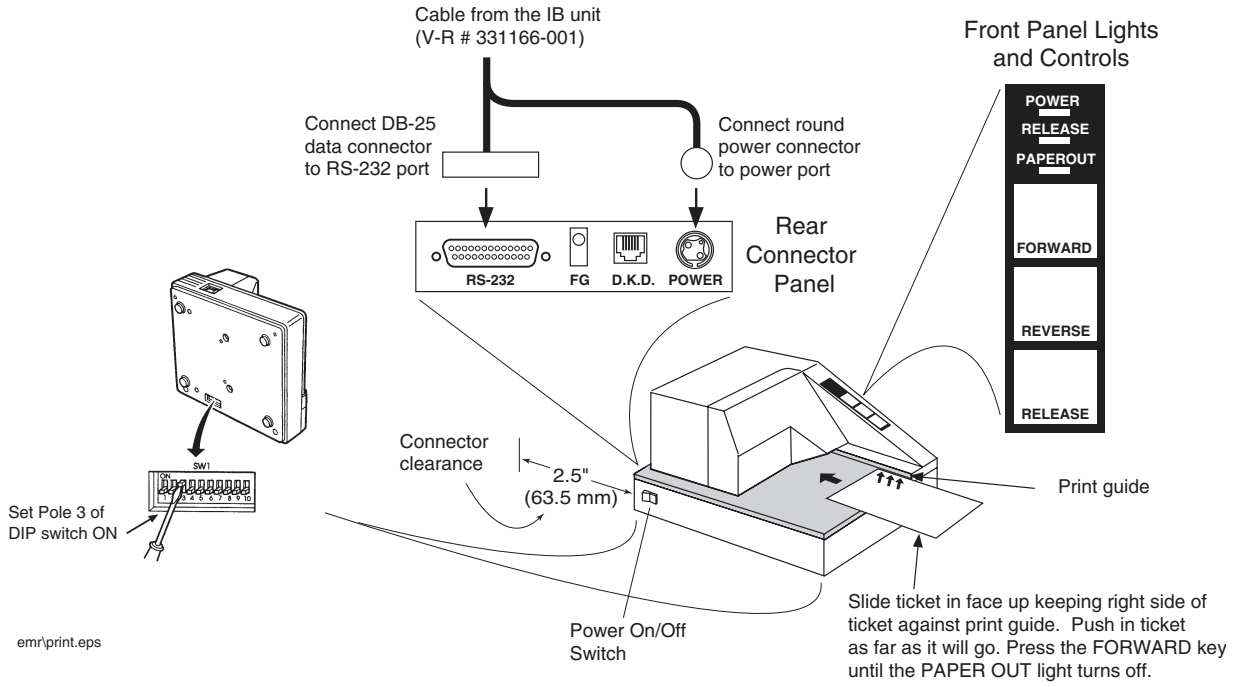


Figure 23. TM-295 Printer

Installing the Remote Display (Optional)

The Remote Display consists of the items listed in Table 11:

Table 11. Remote Display Components

Item	Description	V-R P/N
1	Remote Display Head	845693-X2X
2	Remote Display Install Kit	330020-430
3	Mounting Bracket	846000-024
4	Opt. 4 cond. cable - 6 ft (1.83 m) lg.	846000-107
5	Opt. 4 cond. cable - 40 ft (12.19 m) lg.	846000-106

Table 11. Remote Display Components

Item	Description	V-R P/N
6	Opt. 4 cond. cable - 50 ft (15.24 m) lg.	846000-100
7	Opt. 4 cond. cable - 100 ft (30.48 m) lg.	846000-101
8	Opt. 4 cond. cable - 200 ft (60.96 m) lg.	846000-102
9	Opt. 4 cond. cable - 300 ft (91.44 m) lg.	846000-103
10	Opt. 4 cond. cable - 400 ft (121.92 m) lg.	846000-104
11	Opt. 4 cond. cable - 500 ft (152.4 m) lg.	846000-105

Figure 24 shows the Remote Display assembly and Figure 25 shows how to wire the display to the Interconnection Box. You can mount the display on a wall or dashboard of a truck, a wall in a building, or outside in a hazardous location. Use appropriate fasteners in any of the pre-drilled holes in the base of the optional bracket when attaching the bracket to the mounting surface. Adjust the angle of the display by loosening the side bolts and rotating the unit to the desired position.

Following wiring routing precautions and procedures discussed earlier for the meter mounted Display Head, connect the Remote Display to the Interconnection Box. Wiring connections at the Remote Display are shown in Figure 25. Install optional cord grip fitting in rear of Remote Display for cable egress. Wiring connections at the IB are to the identical terminals of the unused DH terminal block.

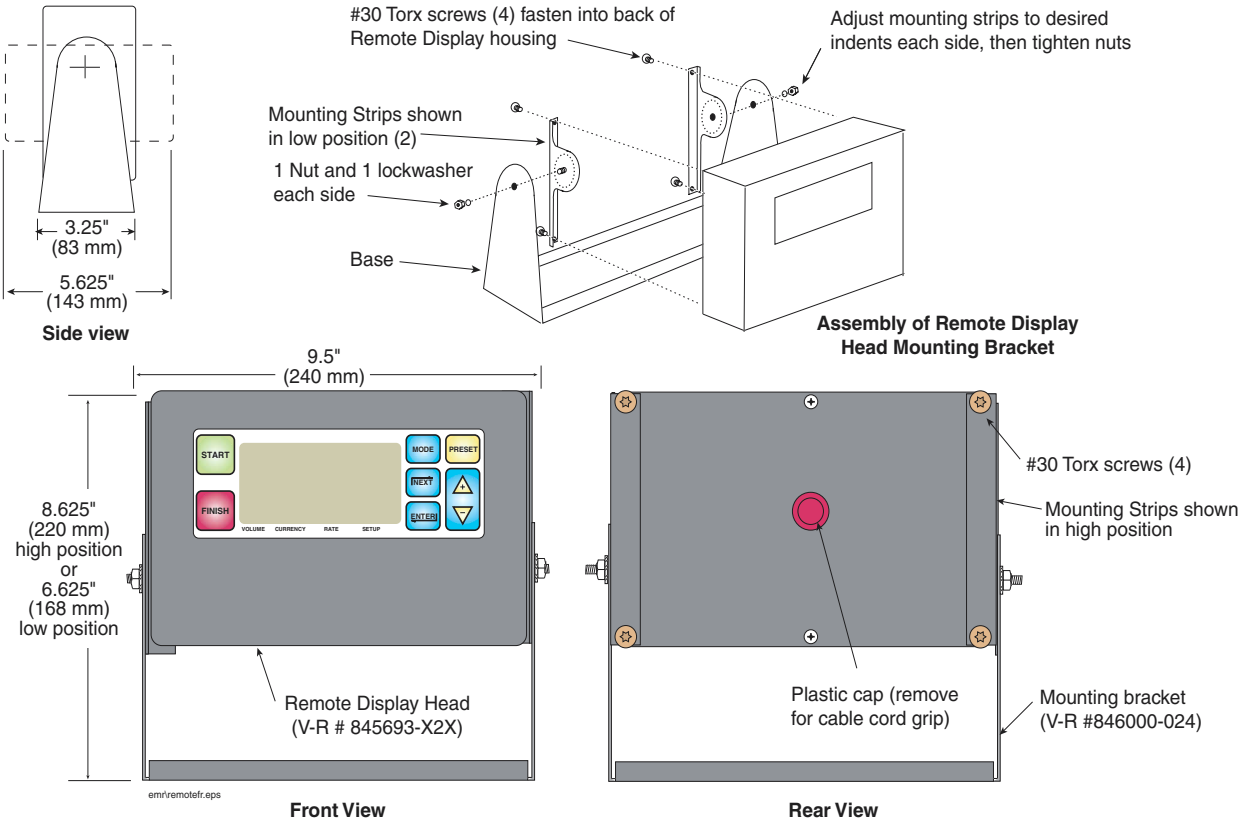


Figure 24. Remote Display Assembly

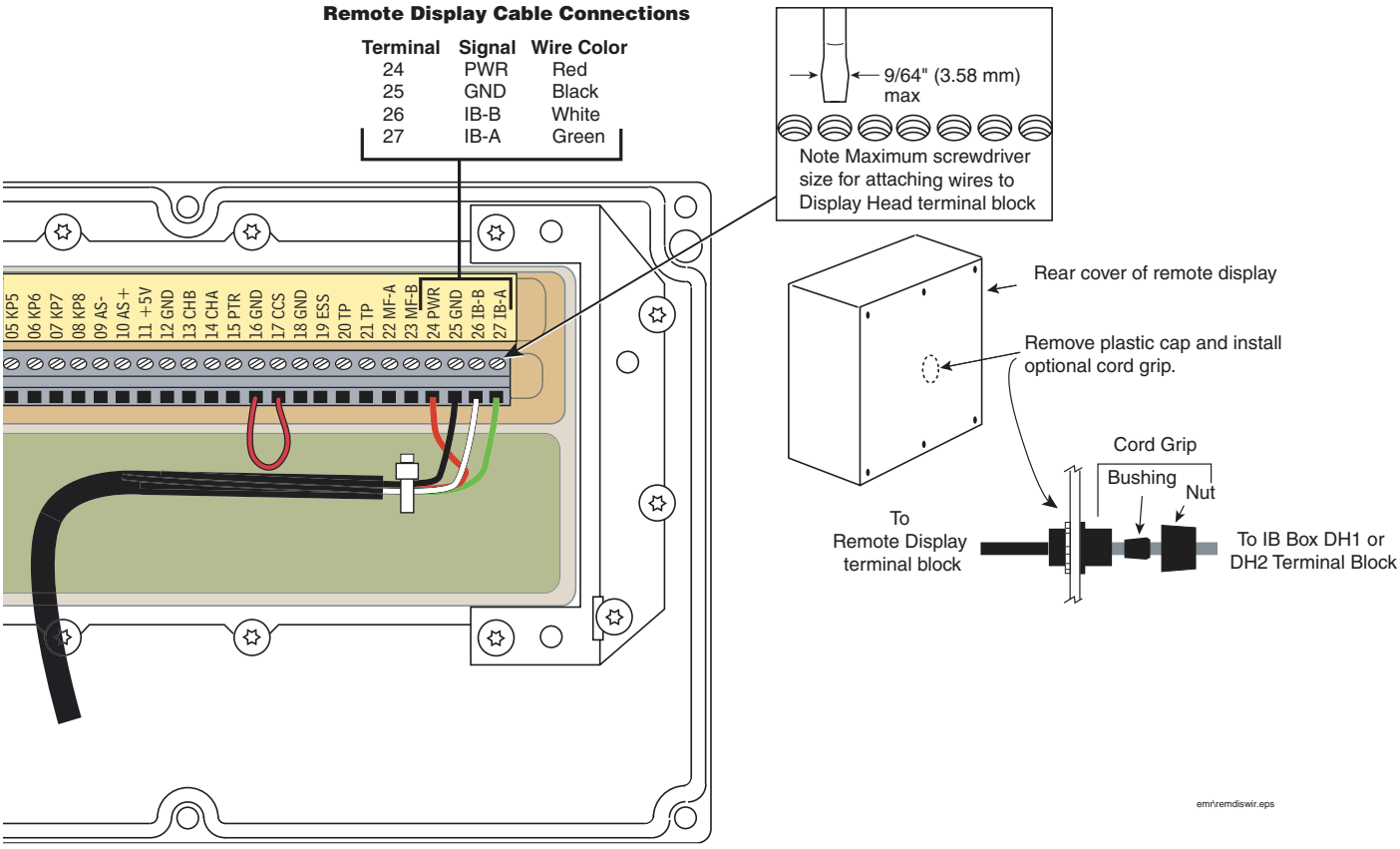


Figure 25. Remote Display Wiring (rear cover removed)

Inhibitors to Unauthorized Meterological Adjustments

The EMR3 uses a wire with a lead seal that prohibits tampering with the weights and measures sensitive set-up and calibration values stored in the Display Head. Once the wire seal is installed, a physical alteration to the Display Head is required to gain access to the parameters that control the metrological parameters called C&C (configuration and calibration). If the seal is broken, and power applied, the user may enter the C&C mode depending on which of the three C&C hardware configurations is installed in the Display Head.

In the C&C mode, metrological parameters are adjusted and calibration of the meter is performed. When in the C&C mode, the EMR3 will not perform a delivery.

Mechanical

The Display Head Cover is secured with four bolts that have holes drilled through their heads. A sealing wire in passed through the holes of two or more of these bolts and secured with a lead seal. This wire sealing method is the same method used to physically seal mechanical registers and removing the cover destroys the seal.

The extended keypad is sealed by rivets and cannot be opened without destruction of the rivets. The keypad is affixed to the register housing by means of a fastener that is attached from the inside of the

housing. Removing the optional keypad can not be accomplished without breaking the same seal that secures the Display Head Cover.

The Interconnection Box (IB) Cover is secured to the IB enclosure by 4 screws and a wire with a lead seal. The sealing holes are located in both the enclosure box and the cover. Removing the cover will destroy the seal.

Electronic

The EMR3 is protected from any adjustments of metrological parameters by means of the C&C jumper or the C&C switch located inside the Display Head. During normal operation, there are two terminal positions that must be electrically connected on the terminal block of the Display Head, positions 16 GND and 17 CCS. Both the C&C switch and the C&C jumper wire are protected and sealed by the cover of the Display Head Housing. Two possible C&C hardware configurations are used in the EMR3.

Method 1 - Jumper Wire: In this configuration a single wire is run between the two terminal positions, 16 and 17. The EMR is in the normal delivery mode when the jumper is installed. When this jumper wire is connected to the two terminal positions, an operator cannot make metrological adjustments and cannot calibrate the system. To go into the C&C mode, remove the jumper from one or both terminals.

Method 2 - Corner Switch: This is a normally open switch with a mounting bracket installed in the corner position of the register housing. When the cover bolt is inserted to secure the cover, it passes through the switch assembly and closes the normally open switch. Conversely when the bolt is removed the switch opens and C&C access is allowed. When using the C&C switch assembly, the sealing wire must pass through the bolt used to mount the corner switch assembly.

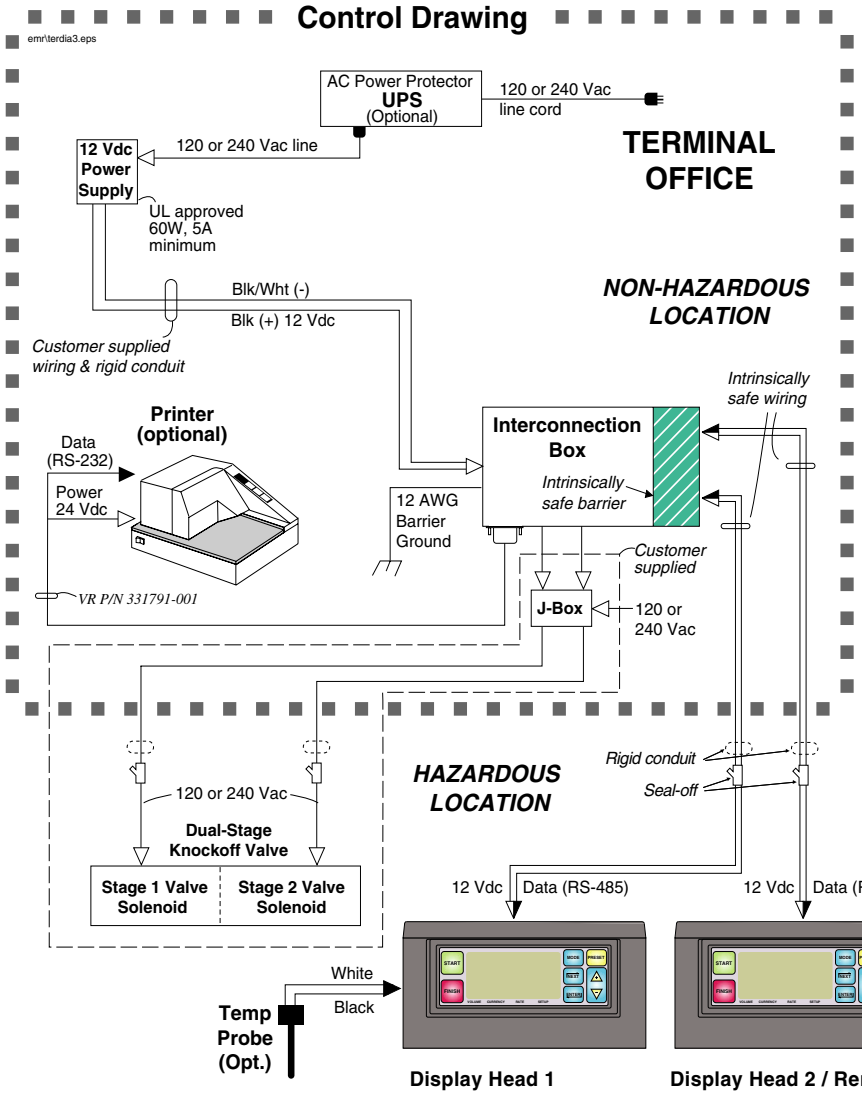
Temperature Probe

The Temperature Probe used by the EMR3 system for performing volume correction is connected to the two TP positions of the terminal block located in the Display Head that is sealed by the mechanical method described above. The Temperature Probe Cable passes through the wall of the housing by way of one of two openings provided. Strain relief for this cable is provided by a compression fitting called a cord grip. If the Temperature Probe Cable becomes disconnected, the system will display an error message and terminate the current delivery.

EMR^3 Terminal Installation

The installation of the EMR^3 System can be broken down into three main steps; installing the Display Head, installing the Interconnect Box, and connecting the optional printer.

Figure 26 shows a typical terminal installation of a single Display Head system.



THE FOLLOWING INFORMATION IS FOR GENERAL REFERENCE AND IS NOT INTENDED TO REPLACE RECOMMENDED NATIONAL ELECTRIC CODE (NEC) PROCEDURES. IT IS IMPORTANT FOR THE INSTALLER TO UNDERSTAND THAT WIRING LOCATED IN CLASS I, GROUP D DIVISION 1 AND 2 INSTALLATIONS SHALL COMPLY WITH THE LATEST APPROPRIATE ARTICLES FOUND IN THE NATIONAL ELECTRIC CODE (NFPA 70).

IMPORTANT: THIS IS A CONTROL DRAWING ONLY AND DOES NOT REFLECT THE ACTUAL LOCATIONS OF CONDUIT ENTRY.

WARNING: IN INSTALLATION AND USE OF THIS PRODUCT, COMPLY WITH THE NATIONAL ELECTRICAL CODE; FEDERAL, STATE AND LOCAL CODES. IN ADDITION, TURN OFF POWER AND TAKE OTHER NECESSARY PRECAUTIONS DURING INSTALLATION, SERVICE AND REPAIR TO PREVENT PERSONAL INJURY, PROPERTY LOSS AND EQUIPMENT DAMAGE.

WARNING: DISCONNECT ALL POWER BEFORE MAKING ANY CONNECTIONS TO PREVENT DEATH, SERIOUS INJURY, EXPLOSION, OR ELECTRICAL SHOCK. THE DISPLAY HEAD MUST NEVER BE OPERATED UNLESS THE FRONT COVER IS CLOSED OVER THE BARRIER TERMINALS IN THE INTRINSICALLY SAFE AREA OF THE INTERCONNECTION BOX.

1. INTRINSICALLY SAFE WIRING SHALL BE INSTALLED IN ACCORDANCE WITH ARTICLE 504-20 OF THE NEC, ANSI/NFPA 70.
2. IN THE NON-INTRINSICALLY SAFE COMPARTMENT OF THE INTERCONNECTION BOX, CONNECT THE #12 AWG OR LARGER DIAMETER BARRIER WIRE TO A GROUND LUG.
3. TO MAINTAIN INTRINSIC SAFETY, DISPLAY HEAD TO INTERCONNECTION BOX WIRING MUST BE RUN IN DEDICATED CONDUIT. MAXIMUM CABLE LENGTH IS 1,000 FEET.
4. INTERCONNECTION BOX SOLENOID RELAY'S CONTACT RATING: 120 VAC, 24 VDC, 5 A.

Figure 26. Typical Terminal Installation

Power Conditioning Equipment Required for Terminal Installations

Two separate electrical components are needed in EMR^3 terminal applications - an Uninterruptable Power Supply (UPS) and a +12 Vdc power supply. Veeder-Root recommendations for this equipment are discussed below.

1. UPS (Uninterrupted Power Supply) - Optional

Veeder-Root recommends the Tripp Lite UPS model BC Pro 450 (or equivalent) for up to 15 minutes of power backup to the +12 Vdc power supply. For pricing or additional information, you can phone Tripp Lite Customer Support at (312) 755-5401; or write them at Tripp Lite Worldwide, 500 N. Orleans, Chicago, IL 60610; or visit their website at *www.tripplite.com*

2. **Power supply** - UL approved, 60 watt, 5 ampere minimum

   Veeder-Root recommends the Digi-Key Power Supply Model 62-1050-ND 12 Vdc, 13 A power supply, or Model 62-1051-ND 24 Vdc, 6.5 A power supply. (See Figure 27 for connection wiring diagram which is identical for either the 12 or 24 Vdc model.) To order, contact Digi-key at (800) 344-4539, or visit their website at *www.digikey.com*.

   .

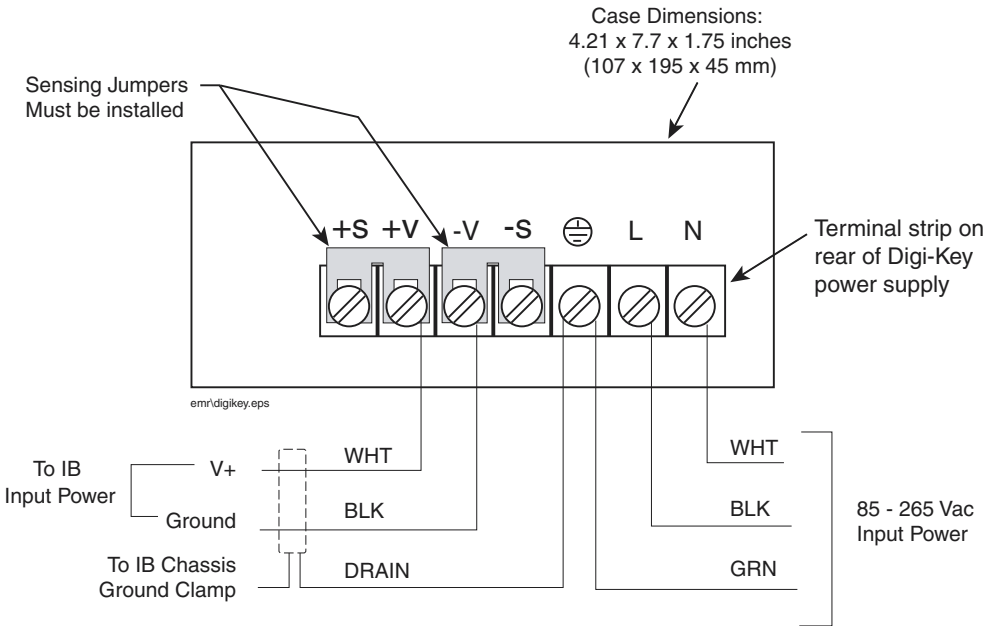


Figure 27. Digi-Key Power Supply Wiring Diagram

Display Head Installation Procedure

1. Remove and put aside the four mounting bolts holding the meter register assembly to the meter adaptor mounting flange (these bolts will be used to attach the Display Head to the meter adaptor mounting flange). Remove the existing mechanical register.
2. If you are replacing a Veeder-Root or Liquid Controls register go to the next step. For more information, start with “Available Parts” on page 2 and continue up to “Neptune Propane Flow Meter Installation”.

   If you are replacing a Brodie, Brooks, or Neptune register install the necessary Meter Adaption Kit as per directions in “Neptune Propane Flow Meter Installation” on page 14.
3. Notice the type of coupling connecting the register/preset to the meter adaptor input shaft.
4. Look at the base of the meter register. The projecting encoder shaft has a small cotter pin inserted in it to keep it from sliding up into the unit and a washer (P/N 011071-933). Remove this cotter pin.

Remove an identical coupling from the installation kit and attach it with an enclosed groove pin to the encoder input shaft projecting from the base of the Display Head (make sure that you support the encoder shaft when inserting the pin to avoid damaging the shaft).

Important ☞ Make sure the washer is on the shaft between the end of the coupling and the Display Head.

5. Remove the four cover bolts of the Display Head and lift off the cover. Put the cover and bolts aside.
6. Orient the encoder input shaft coupling so that it 'mates' with the meter adaptor input shaft, then lower the Display Head onto the meter adaptor mounting flange.
7. Rotate the Display Head on the meter adaptor mounting flange until the display is facing in the desired direction and check to see that the four meter adaptor flange mounting holes align with four of the eight tapped (1/4 - 28 UNF-2B threads) mounting holes in the base of the Display Head's housing. You may have to rotate the Display Head right or left a little to line up four holes. Reuse the four mounting bolts and tighten them securely.
8. If you have the optional temperature probe, remove the existing temperature probe and replace it with the Display Head temperature probe.

Wiring the Display Head

1. With the Display Head cover still off, remove the nut and bushing from the top side panel cord grip connector. Note: the maximum cable length between the Interconnection Box and the Display Head is 1000 feet (304.8 meters).
2. Slide the cord grip nut and then the bushing over the IB cable leads. Pull enough cable through so that the leads reach the terminal block on the Display Assembly and can be tie wrapped to the Pulse Encoder mounting base as shown in Figure 28. Slide the tapered end of the bushing into the cord grip, then screw on the cord grip nut and tighten securely.
3. Attach the four-wire IB cable to the Terminal Block as shown in Figure 28. Attach the drain wire of the IB cable to a grounding lug on the Pulse Encoder mounting base as shown in Figure 28.

   When stripping wire for terminal block connections, be careful not to nick the individual strands. Also, be sure to tighten each terminal so the wire can not be pulled out. A failure to follow either of these instructions can result in signal loss and faulty operation.
4. If you have the optional temperature probe remove the lower cord grip nut and slide it, then the tapered bushing, over the temperature probe cable. Pull enough cable through so that the leads reach the terminal block on the Display Assembly and can be tie wrapped to the Pulse Encoder mounting base as shown in Figure 28. Slide the bushing into the cord grip and then screw the cord grip nut onto the cord grip and tighten securely.

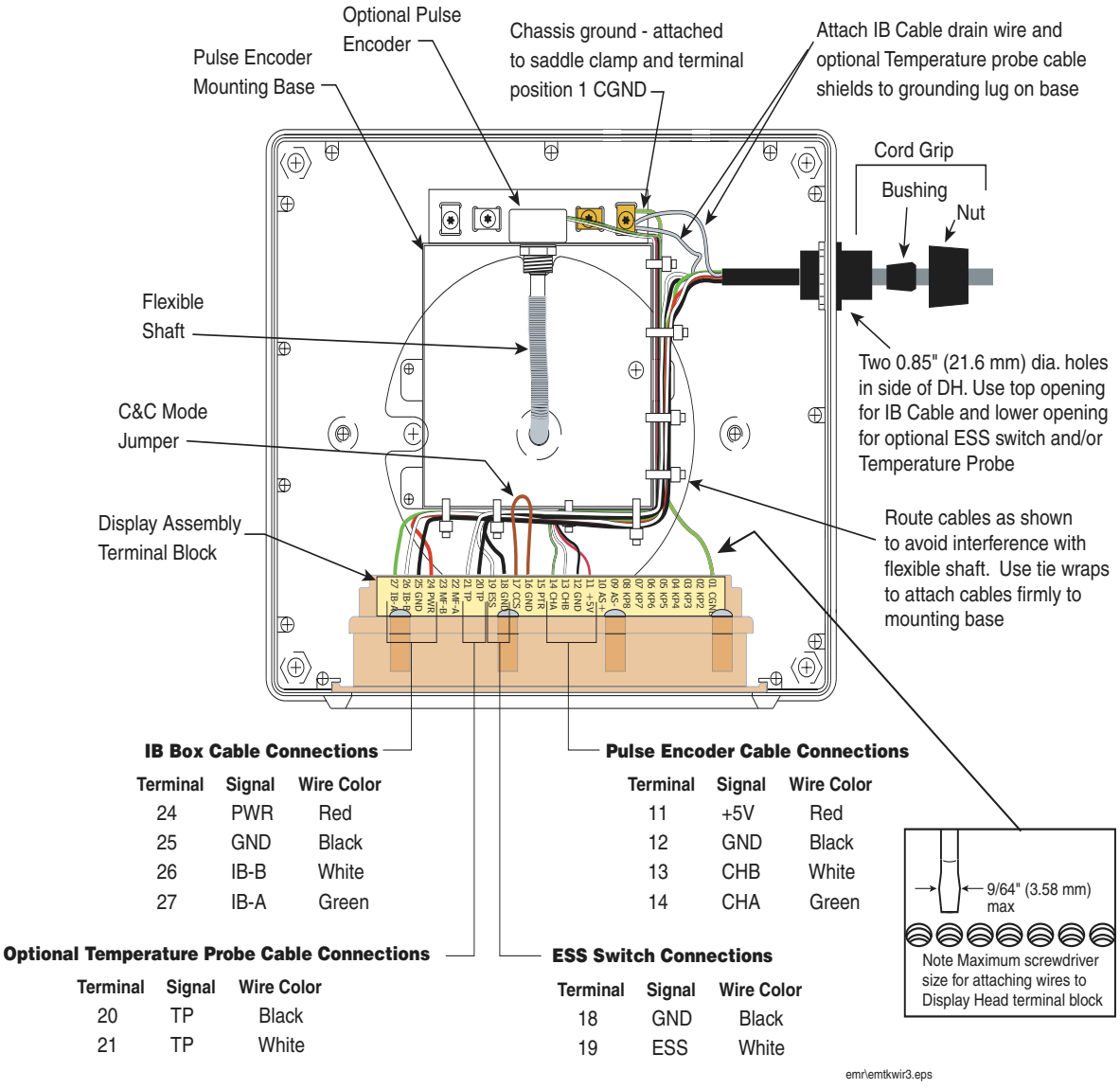
   Attach the shield of the temperature probe cable to a grounding lug on the Pulse Encoder mounting base.
5. Attach each wire (no polarity) of the 2-connector Temperature Probe cable as shown in Figure 28.
6. Tie wrap the IB and temp probe (if installed) cables to the Pulse Encoder mounting base.
7. Replace the Display Head cover and screw in the four cover retaining bolts just enough to hold them in (the cover will be removed later for system calibration).

C&C Mode Switch Options

There are two C&C mode switch configurations:

1. A C&C wire jumper (see Figure 28) - standard configuration. To enter C&C mode, you remove one end of the jumper from its terminal, and you reconnect it when finished.

2. A optional C&C corner switch assembly which fits into a corner of the Display Head's housing (V-R #846000-018). To enter C&C mode, you remove the corner bolt of the Display Head's cover that presses against the switch actuator lever, and you replace the bolt when finished (see Figure 29)


Optional Pulse Encoder
Pulse Encoder Mounting Base
Chassis ground - attached to saddle clamp and terminal position 1 CGND
Attach IB Cable drain wire and optional Temperature probe cable shields to grounding lug on base
Cord Grip
Bushing
Nut
Flexible Shaft
Two 0.85" (21.6 mm) dia. holes in side of DH. Use top opening for IB Cable and lower opening for optional ESS switch and/or Temperature Probe
C&C Mode Jumper
Display Assembly Terminal Block
Route cables as shown to avoid interference with flexible shaft. Use tie wraps to attach cables firmly to mounting base
9/64" (3.58 mm) max
Note Maximum screwdriver size for attaching wires to Display Head terminal block
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IB Box Cable Connections

Terminal	Signal	Wire Color
24	PWR	Red
25	GND	Black
26	IB-B	White
27	IB-A	Green

Pulse Encoder Cable Connections

Terminal	Signal	Wire Color
11	+5V	Red
12	GND	Black
13	CHB	White
14	CHA	Green

Optional Temperature Probe Cable Connections

Terminal	Signal	Wire Color
20	TP	Black
21	TP	White

ESS Switch Connections

Terminal	Signal	Wire Color
18	GND	Black
19	ESS	White

Figure 28. Display Head Cable Wiring and Switch Locations

Corner Mounted C&C Switch

Removal of corner bolt releases actuator lever of C&C switch allowing entry into C&C Mode

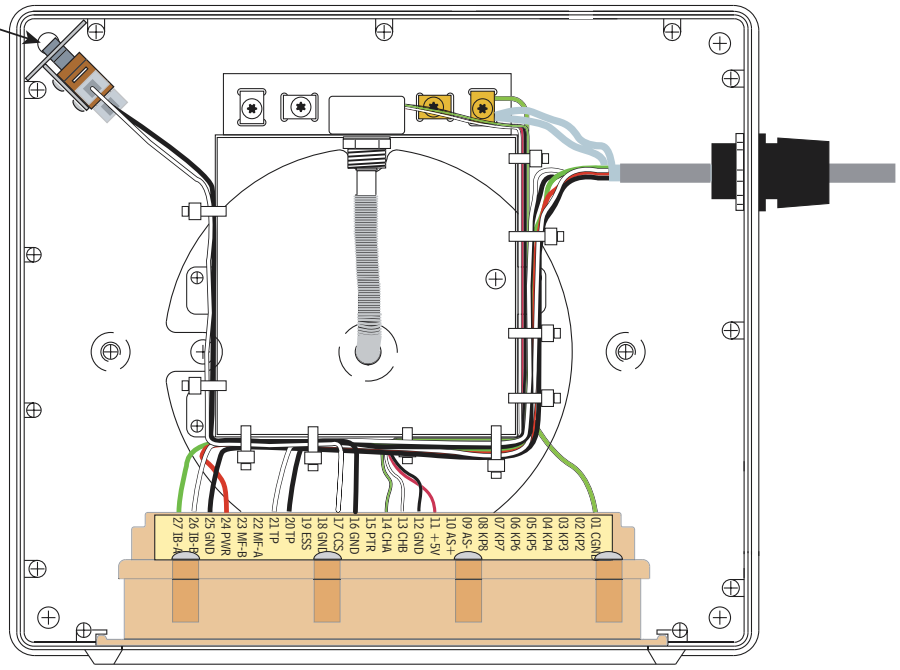

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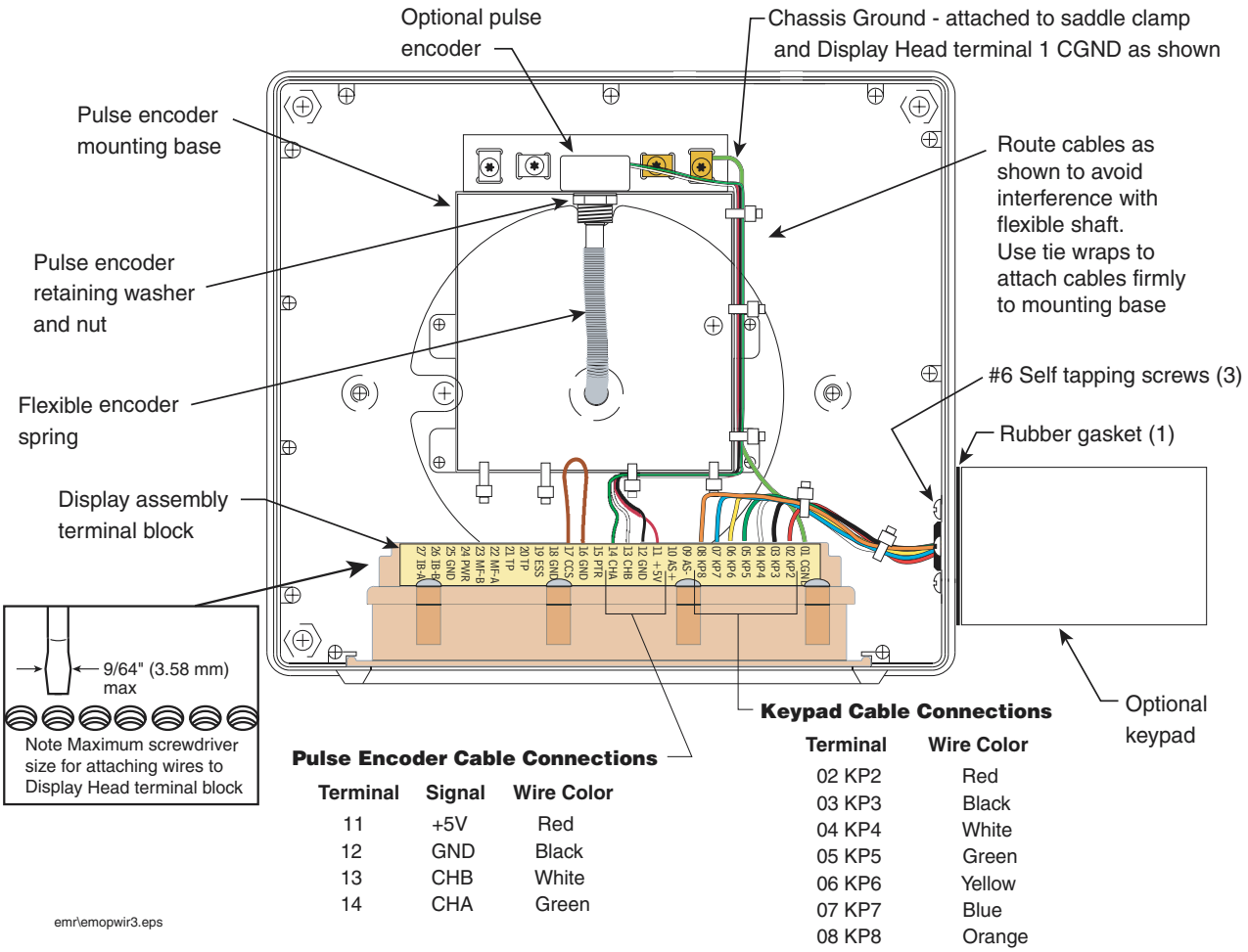
Figure 29. Optional C&C Mode Switch Confifuration

Installing Optional Keypad Kit

Figure 30 shows the installation and wiring of the optional keypad. To attach the keypad housing mounting screws, you may have to pull/slide up the display assembly terminal block away from the Display Head. Insert the keypad wires through the center hole in the gasket, slide the gasket down against the keypad and align its three holes with the mounting holes in the keypad. Hold the keypad against the Display Head and screw in the 3 mounting screws as shown in Figure 30. Slide the terminal block down in place, and then make the wiring connections as shown in Figure 30.

Installing Optional Pulse Encoder Kit

Figure 30 shows the installation and wiring of the optional pulse encoder. Insert the pulse encoder into the hole in the bracket, install the washer, screw on the retaining nut, then make the wiring connections. Slide one end of the flexible encoder spring onto the shaft (from the mechanical meter) in the base of the Display Head and the other end onto the shaft of the pulse encoder (push the spring as far as it will go onto each shaft).


Optional pulse encoder
Chassis Ground - attached to saddle clamp and Display Head terminal 1 CGND as shown
Pulse encoder mounting base
Route cables as shown to avoid interference with flexible shaft. Use tie wraps to attach cables firmly to mounting base
Pulse encoder retaining washer and nut
#6 Self tapping screws (3)
Flexible encoder spring
Rubber gasket (1)
Display assembly terminal block
9/64" (3.58 mm) max
Note Maximum screwdriver size for attaching wires to Display Head terminal block
Optional keypad
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Pulse Encoder Cable Connections

Terminal	Signal	Wire Color
11	+5V	Red
12	GND	Black
13	CHB	White
14	CHA	Green

Keypad Cable Connections

Terminal	Wire Color
02 KP2	Red
03 KP3	Black
04 KP4	White
05 KP5	Green
06 KP6	Yellow
07 KP7	Blue
08 KP8	Orange

Figure 30. Optional Pulse Encoder and Keypad Installations

Installing the Interconnection Box

National Electrical Code Compliance

The following information is for general reference and is not intended to replace recommended National Electric Code (NEC) procedures. It is important for the installer to understand that electrical equipment and wiring located in Class I, Division 1 and 2 installations shall comply with the latest appropriate articles found in the National Electric Code (NFPA 70) and the Automotive and Marine Service Station Code (NFPA 30A).

Wire Type for Non-Bonded Metallic or PVC Conduit

Veeder-Root requires the use of shielded cable when using non-bonded metallic or PVC conduit in any portion of the wiring between the Display Head and the IB. In these installations, shielded cable must be rated less than 100 picofarad per foot and be manufactured with a material suitable for the environment.

Use either the 4-wire cable supplied by V-R, P/N 846000-X00 or use one of the following cables: Belden Type 9855 or Alpha Type 9819C. These two alternate cables both have dual pair data cables rated less than 100 picofarad per foot, with a PVC jacket, 22 AWG solid conductors, and a single drain wire. Note that conductor wire colors vary depending on the cable manufacturer (Caution: the Display Head to IB wiring illustrations in this section show wire colors in the V-R cable. Alternate cables may have different wire colors).

Important ☞ Field wiring may be both above ground or below grade.

Wire Length

Improper system operation could result in undetected potential environmental and health hazards if the Display Head to IB wire runs exceed 1000 feet (304.8 m). Wire runs must be less than 1000 feet to be UL acceptable for this application.

Mounting and Wiring the IB Unit

1. The physical dimensions of the Interconnection Box (IB) are shown in Figure 17 on page 24. The IB is installed in the terminal office. Use four, 3/16” (4 mm) bolts to mount the IB to the mounting surface.
2. Table 12 and Figure 31 show IB Power Side terminal wiring connections. Use Power Side knockouts (left side of IB) for all cables attaching to this terminal block.
3. Table 13 and Figure 31 show the IB intrinsically safe terminal wiring connections. Use Intrinsically Safe Side knockouts (right side of IB under cover) for Display Head cable entries. The drain wire in each Display Head cable must be connected to the adjacent chassis ground clamp.
4. For optional knockoff valve solenoid wires use either 2-conductor (V-R P/N 848100-2XX) or 3-conductor cable (V-R P/N 848100-3XX) - order in 100 feet (30.48 m) increments. Wire each solenoid using V-R Suppressor Diode kit (V-R P/N 846000-022) as shown in Figure 32.

Important ☞ All field wiring entering the IB box should be run as straight as possible from the conduit entry knockout to their designated terminal connectors. Especially avoid intermingling wiring from the solenoids with other lower voltage wiring.

The printer **must** be within 6 feet (1.83 m) of the IB box.

Table 12. Power Side Wiring for IB Box

Input	Terminal Label
Input Power	Ground
	V+
Pulse Input	Pulse In (-)
	Pulse In (+)
	Input Voltage
	5 V Out
	12 V Out
	24 V Out

Table 12. Power Side Wiring for IB Box

Input		Terminal Label
Switch Inputs		Ground
		Stop DH1
		Ground
		Start DH1
		Ground
		Stop DH2
		Ground
		Start DH2
Analog Signal		AS (-)
		AS (+)
Pulse Output		Ground
		POUT -1
IB Network		RS-485 B
		RS-485 A
		Ground
Port 2 Slip Printer Roll Printer OBC AUX		RX
		TX
		Ground
		CTS
		POUT-2/RTS
Port 1 Slip Printer Roll Printer OBC AUX		Ground
		Power
		PRN-RX
		PRN-TX
DH 1 Relays	Relay 2	COM
		N.O.
	Relay 1	COM
		N.O.
DH 2 Relays	Relay 2	COM
		N.O.
	Relay 1	COM
		N.O.

For Port 2 assignments, see Figure 27 in Setup Manual.

For Port 1 assignments, see Figure 26 in Setup Manual.

Table 13. Display Head Connections to IB

Input	Terminal Label
Display Head 1	IB-A
	IB-B
	Gnd
	Pwr

Table 13. Display Head Connections to IB

Input	Terminal Label
Display Head 2	IB-A
	IB-B
	Gnd
	Pwr

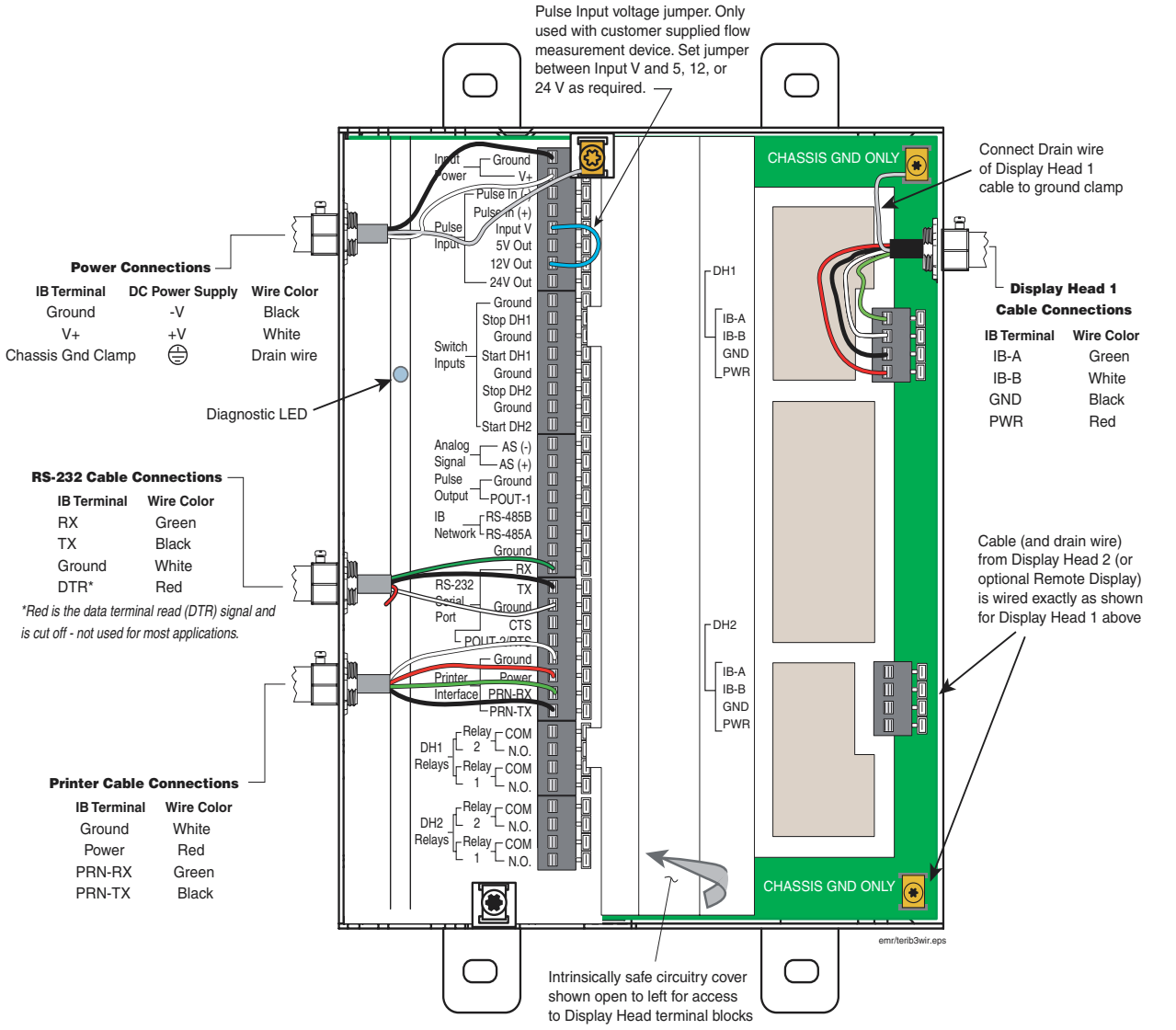

Figure 31. Terminal IB Wiring

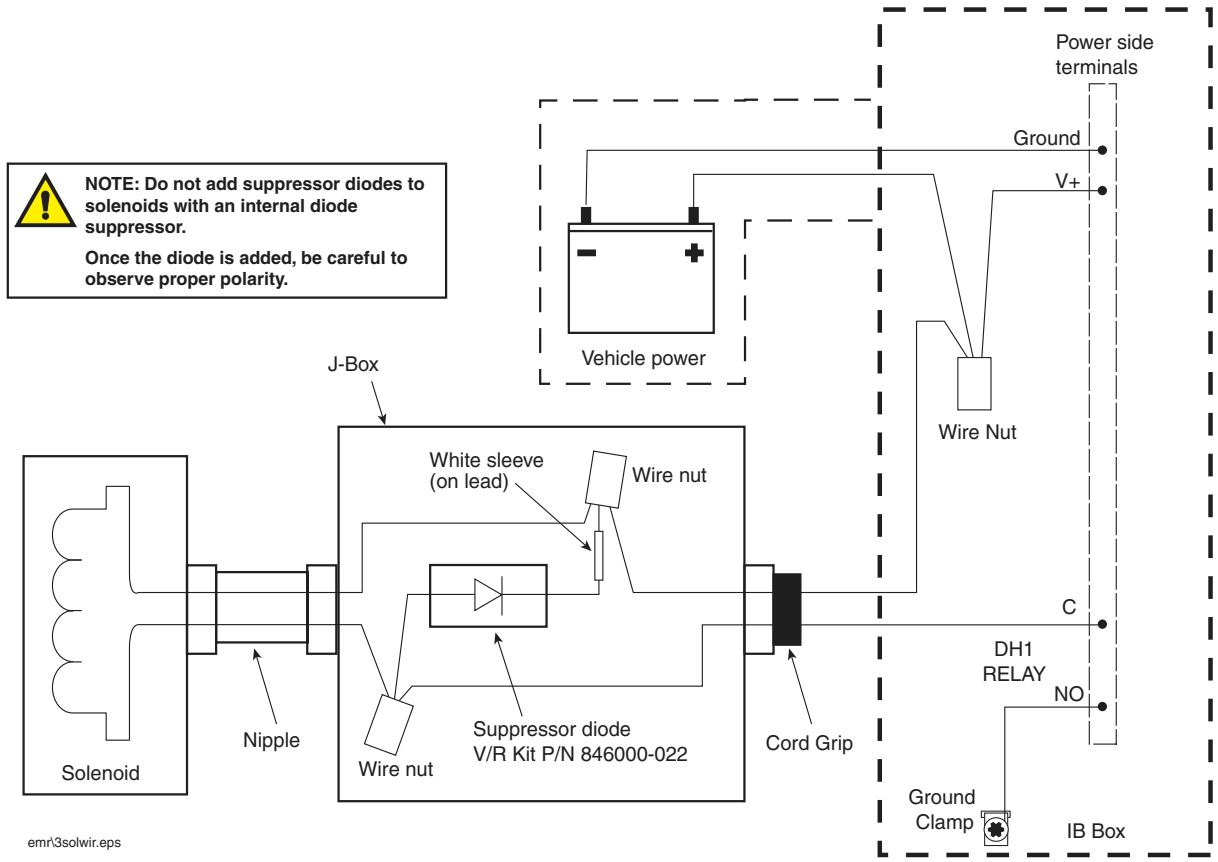

Figure 32. Wiring solenoid with external suppressor diode supplied by Veeder-Root - Typical

Installing the Optional Printer

The Epson TM-295 dot matrix slip printer is placed on a desk in the terminal's office. A power/data cable is included in the printer kit. Figure 33 shows the front panel lights and controls, and the rear panel connections to the TM-295 printer.

Figure 33 also illustrates required setting of the TM-295 printer's address code DIP switch 3 (located on the base of the printer).

Attach the four wires of the printer power/data cable to the appropriate terminals of the Power Side terminal block in the IB (Figure 31) and the DB-25 connector and the round power connector to the appropriate connectors on the rear of the printer (Figure 33).

Installing the Remote Display (Optional)

To install the optional Remote Display see "Installing the Remote Display (Optional)" on page 45

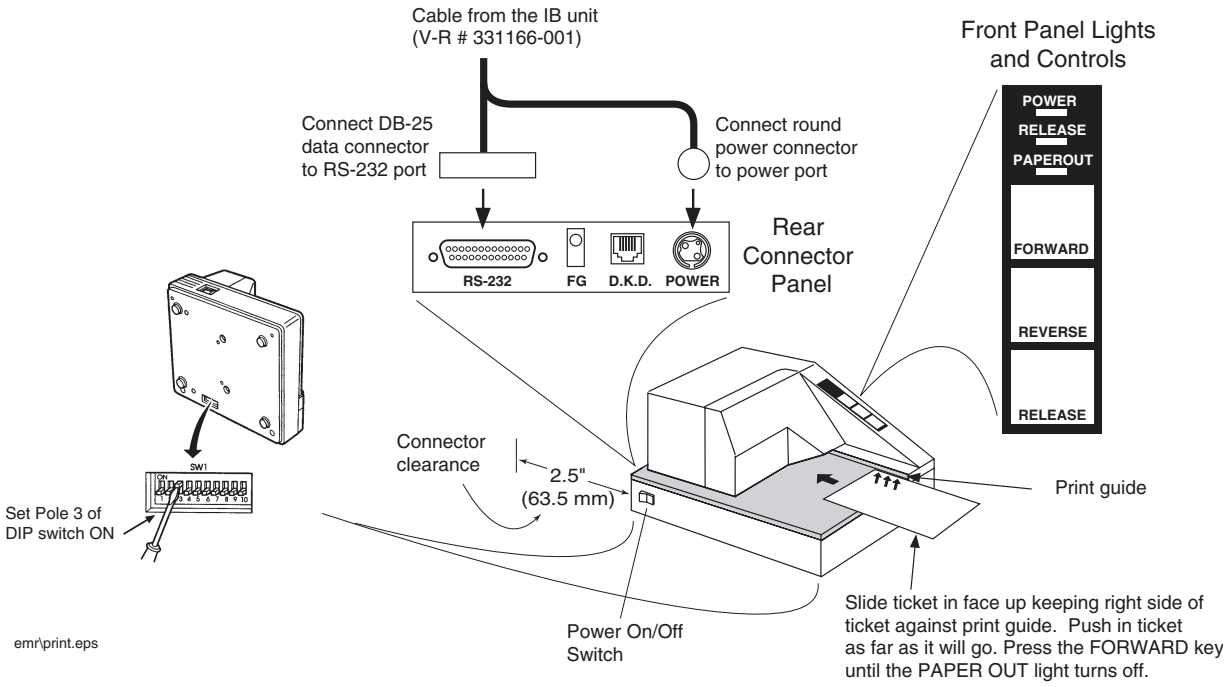

Figure 33. TM-295 Printer

RS-232 Peripheral Equipment Requirements

Any peripheral equipment connected to an RS-232 serial port must meet the following criteria:

1. Peripheral equipment must be UL approved.
2. The equipment must have an EIA standard RS-232C or RS-232D communications protocol.
3. The equipment must NOT be installed over or in a hazardous location.
4. Maximum cable length is 50 feet (15.24 m).
5. Serial Parameters
   - Baud: 9600
   - Parity: None
   - Stop bits: 1
   - Data bits: 8

   Note: for a list of serial commands, contact Veeder-Root directly.

Pulse Output for EMR³

Range of Values Allowed for SET PULSES/VOL

- Minimum: 0.0
- Maximum: 99.999.9

Hardware Signals

- Pulse Output 1: P Out-1 is an open collector output with an internal pull-up resistor (2.2K) tied to V_{in}. The output voltage can be set to either 5, 12, or 24 volts depending on the location of the V_{in} jumper wire.
- Pulse Output 2: ±10 volt, maximum cable length 50 feet (15.24 m)
- Typical Duty Cycle: Variable length square wave
- Minimum Period: 1.072 ms
- Maximum Frequency: 933 Hz
- Minimum Lag Time: 460 ms (if within flow rates)

Flow Rate Limits Based on the Typical Time It Takes the IB to Send Pulses

Setting	Max Flow Rate
0.1 pulse/gallon	250,000 gpm
1.0 pulse/gallon	25,000 gpm
10.0 pulses/gallon	2,500 gpm
100 pulses/gallon	250 gpm
1,000 pulses/gallon	25 gpm

Example:

Set the PULSES/VOL to 100 pulses per gallon. Deliver 3,000 gallons at a flow rate of 600 gpm. The actual delivery takes 5 minutes, but it may take the EMR3 another 7 minutes to transmit the last 175,000 pulses. Consider both the flow rate and the time it takes to send all of the pulses prior to setting the PULSES/VOL value.

Appendix A: EMR^3 Safety Instructions

1. ATEX approved EMR3 systems are marked with the following information defining its limits for safe use. The product should not be installed or used in hazardous locations that are not compatible with the following:

   EEx ia II A T4

   Ui: 13.365 Vdc

   Ii: 687 mA

   Pi: 2.3 W

   Li: 208 µH

   Ci: 13.3 µF

   T_{amb} -25°C to +70°C

   Defined per certification CE_{600} ⟨Ex⟩ II 1G DEMKO SYST 02 ATEX 0216184 EEx ia IIA T4

2. Refer to the site preparation procedures in this manual for general instructions on safe installation, use, and replacement.
3. The EMR3 system does require periodic calibration. Follow the calibration procedures outlined in the Veeder-Root EMR3 Setup and Operation manual (P/N 577013-766).
4. The EMR3 system is not serviceable. If a failure occurs, the unit should be replaced in accordance with the requirements of this manual.

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